



**CORE**

Public Health Functions for BC

**Evidence Review:**  
**Unintentional Injury**  
**Prevention**

**Population Health and Wellness**  
**BC Ministry of Health**

November 2007

*This is a review of evidence and best practice that should be seen as a guide to understanding the scientific and community-based research, rather than as a formula for achieving success. This review does not necessarily represent ministry policy, and may include practices that are not currently implemented throughout the public health system in BC. This is to be expected as the purpose of the Core Public Health Functions process—consistent with the quality improvement approach widely adopted in private and public sector organizations across Canada—is to put in place a performance improvement process to move the public health system in BC towards evidence-based best practice. Health authorities will develop public performance improvement plans with feasible performance targets and will develop and implement performance improvement strategies that move them towards best practice in the program component areas identified in the Model Program Paper. These strategies, while informed by the evidence in this review, will be tailored to local context.*

*This Evidence Review should be read in conjunction with the accompanying Model Core Program Paper.*

***Evidence Review prepared by:***

BC Injury Research and Prevention Unit

***Evidence Review accepted by:***

Population Health and Wellness, Ministry of Health (November 2007)

Core Functions Steering Committee (November 2007)

## TABLE OF CONTENTS

|  |    |
|--|----|
| Executive Summary .....                                    | i  |
| 1.0 Overview/ Setting the Context.....                     | 1  |
| 1.1 An Introduction to This Paper.....                     | 1  |
| 1.2 Limitations .....                                      | 3  |
| 2.0 Methodology .....                                      | 4  |
| 2.1 Search Strategy .....                                  | 4  |
| 2.2 Selection of Eligible Reviews.....                     | 4  |
| 2.3 Quality Assessment.....                                | 5  |
| 2.4 Reference Articles.....                                | 5  |
| 2.5 Data Extraction .....                                  | 5  |
| 2.6 Strength of the Evidence.....                          | 5  |
| 2.7 Limitations .....                                      | 6  |
| 3.0 Background.....  | 7  |
| 3.1 Children and Youth.....                                | 7  |
| 3.2 Adults and Seniors .....                               | 10 |
| 4.0 Burns and Scalds Prevention .....                      | 15 |
| 4.1 Hot Water and Liquid Scalds.....                       | 15 |
| 4.2 Smoke Alarms.....                                      | 16 |
| 4.3 Sleepwear.....   | 17 |
| 4.4 Fire Skills Training .....                             | 17 |
| 4.5 Fireworks .....  | 18 |
| 4.6 Community-based Interventions.....                     | 18 |
| 4.7 Interpretation of the Evidence and Considerations..... | 19 |
| 5.0 Unintentional Poisoning Prevention .....               | 20 |
| 5.1 Community-based Interventions.....                     | 20 |
| 5.2 Child-Resistant Packaging .....                        | 20 |
| 5.3 Warning Labels.....                                    | 21 |
| 5.4 Bittering Agents.....                                  | 22 |
| 5.5 Poison Control Centres .....                           | 22 |
| 5.6 Drug Form.....   | 23 |
| 5.7 Physician-based Education .....                        | 23 |
| 5.8 Interpretation of the Evidence and Considerations..... | 23 |
| 6.0 Drowning Prevention.....                               | 24 |
| 6.1 Pool Fencing and Alarms.....                           | 24 |
| 6.2 The Role of Alcohol in Drowning .....                  | 25 |
| 6.3 Swimming Lessons .....                                 | 25 |
| 6.4 Boating Safety Education .....                         | 26 |
| 6.5 Interpretation of the Evidence and Considerations..... | 27 |
| 7.0 Bicycle and Pedestrian Injury Prevention.....          | 28 |
| 7.1 Traffic Calming.....                                   | 29 |
| 7.2 Speed Cameras.....                                     | 29 |
| 7.3 Community-based Interventions.....                     | 30 |
| 7.4 Road Safety Skills Training.....                       | 31 |

---

## ***Core Public Health Functions for BC: Evidence Review***

### **Unintentional Injury Prevention**

---

|      |  |    |
|------|--|----|
| 7.5  | Bicycle Helmet Effectiveness .....   | 32 |
| 7.6  | Bicycle Helmet Legislation.....  | 32 |
| 7.7  | Education to Increase Bicycle Helmet Use.....                                      | 33 |
| 7.8  | Bicycle Lanes.....   | 34 |
| 7.9  | Daylight Savings Time .....  | 34 |
| 7.10 | Visibility Aids, Lights and Reflective Clothing .....                              | 35 |
| 7.11 | Vehicle Modifications.....   | 35 |
| 7.12 | Interpretation of the Evidence and Considerations .....                            | 36 |
| 8.0  | Suffocation, Asphyxiation, Foreign Body Aspiration, and Ingestion Prevention ..... | 37 |
| 8.1  | Legislation and Product Modification .....   | 37 |
| 8.2  | Education .....  | 38 |
| 8.3  | Interpretation of the Evidence and Considerations.....                             | 38 |
| 9.0  | Falls Prevention Among Children .....  | 39 |
| 9.1  | Playground Safety .....  | 39 |
| 9.2  | Shopping Carts.....  | 40 |
| 9.3  | Community-based Falls Prevention Programs.....                                     | 40 |
| 9.4  | Window Bars .....  | 40 |
| 9.5  | Interpretation of the Evidence and Considerations.....                             | 41 |
| 10.0 | Community-based Injury Prevention.....   | 42 |
| 10.1 | General Injury Prevention Interventions.....                                       | 42 |
| 10.2 | World Health Organization Safe Communities Model.....                              | 44 |
| 10.3 | Alcohol-related Injury Prevention Interventions .....                              | 45 |
| 10.4 | Mass Media.....  | 45 |
| 10.5 | Interpretation of the Evidence and Considerations .....                            | 46 |
| 11.0 | Safety Devices and Home Modifications .....  | 47 |
| 11.1 | Educational Campaigns and Provision of Safety Devices.....                         | 47 |
| 11.2 | Home Modifications .....   | 47 |
| 11.3 | Interpretation of the Evidence and Considerations .....                            | 48 |
| 12.0 | Motor Vehicle Occupant Restraint .....   | 49 |
| 12.1 | Child Motor Vehicle Restraint Promotion Programs.....                              | 49 |
| 12.2 | Child Car Seat Loan Programs .....   | 50 |
| 12.3 | Interventions to Promote the Use of Booster Seats .....                            | 51 |
| 12.4 | Seat Belt Laws .....   | 51 |
| 12.5 | Enforcement of Legislation.....  | 52 |
| 12.6 | Primary Enforcement Laws .....   | 53 |
| 12.7 | Interpretation of the Evidence and Considerations.....                             | 53 |
| 13.0 | Poisoning Prevention Among Youth and Adults.....                                   | 55 |
| 13.1 | Regulations to Restrict Sales of Paracetamol (Acetaminophen) .....                 | 56 |
| 13.2 | Pesticide Exposure .....   | 56 |
| 13.3 | Safe and Proper Storage.....   | 57 |
| 13.4 | Prevention Program Development.....  | 57 |
| 13.5 | Interpretation of the Evidence and Considerations .....                            | 57 |
| 14.0 | Falls Prevention Among Youth and Adults .....                                      | 58 |
| 14.1 | Occupational Injuries: Construction .....  | 58 |
| 14.2 | Fall Technique .....   | 59 |
| 14.3 | Slip Prevention on Icy Surfaces.....   | 59 |

---

## *Core Public Health Functions for BC: Evidence Review*

### **Unintentional Injury Prevention**

---

|      |   |    |
|------|---|----|
| 14.4 | Falls in Public Places .....                            | 59 |
| 14.5 | Interpretation of the Evidence and Considerations ..... | 59 |
| 15.0 | Falls Prevention Among Seniors .....                    | 60 |
| 15.1 | Exercise/Physical Therapy Interventions.....            | 60 |
| 15.2 | Environmental Modifications .....                       | 60 |
| 15.3 | Clinical Interventions.....                             | 61 |
| 15.4 | Population-based Interventions.....                     | 61 |
| 15.5 | Medication Modification .....                           | 62 |
| 15.6 | Hip Protectors .....                                    | 62 |
| 15.7 | Multi-factorial Interventions.....                      | 62 |
| 15.8 | Education .....   | 63 |
| 15.9 | Interpretation of the Evidence and Considerations.....  | 63 |
| 16.0 | Future Directions .....                                 | 65 |
|      | References .....  | 66 |

### **Appendices**

|             |   |    |
|-------------|---|----|
| Appendix 1: | Background on Harborview Injury Prevention & Research Center Systematic Reviews ..... | 74 |
| Appendix 2: | Search Strategies .....   | 75 |
| Appendix 3: | Sample Inclusion/Exclusion Form.....  | 78 |
| Appendix 4: | Modified Oxman Quality Assessment Tool.....   | 79 |
| Appendix 5: | Data Extraction Tables.....   | 80 |

### **List of Figures**

|             |   |    |
|-------------|---|----|
| Figure 3.1: | Rates of Unintentional Injury Mortality per 100,000 Population, by Cause, Children and Youth (Age 0–24 Years), BC, 1987–2000 .....      | 8  |
| Figure 3.2: | Rates of Unintentional Injury Hospitalization per 100,000 Population, by Cause, Children and Youth (Age 0–24 Years) BC, 1989–2000 ..... | 9  |
| Figure 3.3  | Rates of Unintentional Injury Mortality per 100,000 Population, by Cause, Adults (Age 25 Years and Over) BC, 1990–2003.....             | 12 |
| Figure 3.4  | Rates of Unintentional Injury Hospitalization per 100,000 Population, by Cause, Adults (Age 25 Years and Over) BC, 1990–2003.....       | 14 |

### **List of Tables**

|            |  |    |
|------------|--|----|
| Table 3.1: | Average Annual Age-Specific Mortality Rates per 100,000 and Number of Unintentional Injury Deaths, BC, 1987–2000.....                            | 7  |
| Table 3.2  | Average Annual Age-Specific Hospitalization Rates per 100,000 Population and Number of Unintentional Injuries, BC, 1989–2000 .....               | 9  |
| Table 3.3: | Number of Unintentional Injuries and Rate of Injury Hospital Separations per 100,000 Population, by Age Group and Sex, BC, 1990/91–2003/04 ..... | 10 |
| Table 3.4  | Number of Unintentional Injuries and Rate of Injury Hospital Separations per 100,000 Population, by Age Group and Sex, BC, 1990/91–2003/04 ..... | 13 |
| Table 4.1: | Reviews Included in Burns and Scalds Prevention Review.....  | 15 |
| Table 5.1: | Reviews Included in Poisoning Prevention Review.....   | 20 |
| Table 6.1: | Reviews Included in Drowning Prevention Review .....   | 24 |
| Table 7.1: | Reviews Included in Bicycle and Pedestrian Injury Prevention Review .....  | 28 |

---

***Core Public Health Functions for BC: Evidence Review***  
**Unintentional Injury Prevention**

---

|             |  |    |
|-------------|--|----|
| Table 8.1:  | Reviews Included in Suffocation, Asphyxiation, Foreign Body Aspiration,<br>and Ingestion Prevention Review ..... | 37 |
| Table 9.1:  | Reviews Included in Falls Prevention Review .....  | 39 |
| Table 10.1: | Reviews Included in Community-based Injury Prevention Review .....   | 42 |
| Table 11.1: | Reviews Included in Safety Devices and Home Modifications Review .....   | 47 |
| Table 12.1: | Reviews Included in Motor Vehicle Occupant Restraint Review .....  | 49 |
| Table 13.1: | Reviews Included in Poisoning Injury Prevention Review .....   | 55 |
| Table 14.1: | Reviews Included in Falls Injury Prevention Review .....   | 58 |

## **EXECUTIVE SUMMARY**

### **Summary Statement**

Injuries are the leading cause of death and hospitalization for children, youth and adults (to age 44) in BC, and the fourth leading cause of death across all age groups. Approximately 1,200 people in BC are injured each day and of these 4 will die. Each year, approximately 424,000 (1998) preventable, unintentional injuries occur. These injuries cost an estimated \$2.1 billion per year, or \$513 per British Columbian (2001).

### **Leading Causes of Unintentional Injuries:**

- Among children and youth, 1 to 24 years, the leading causes of death from unintentional injuries (1987 to 2000) are motor vehicle traffic (61 per cent), drowning/submersion (9 per cent) and poisoning (8 per cent); while leading causes of hospitalization (1989 to 2000) include falls (33 per cent), motor vehicle traffic (19 per cent) and being struck by an object (12 per cent).
- Among adults 25 years and over, leading causes of death from unintentional injuries (1990 to 2003) are falls (27 per cent), poisoning (25 per cent) and motor vehicle crashes (24 per cent); causes of hospitalization (1990 to 2003) include falls (40 per cent), adverse effects (17 per cent) and motor vehicle crashes (6 per cent).

Injuries are not accidents; they follow predictable patterns, are measurable and preventable. Research has shown that multi-faceted initiatives that use at least two of the following general approaches have the greatest chance of being successful in reducing the burden of injury:

- *Education* – Education and skill training are the most commonly used strategies in injury prevention. Although education is not shown to be very effective on its own, it is an essential element for supporting engineering and enforcement strategies. Educating policymakers and the public usually precedes action in terms of public policy and engineering modifications.
- *Enforcement/Legislation* – Enforcement strategies are generally effective, more so when they are enforced properly.
- *Engineering/Environment* – Engineering strategies involve the development or modification of products and environments to increase safety. Generally, engineering efforts are effective.
- *Economic Incentive and Disincentives* – Economic incentives involve financial benefits to individuals who take specific injury prevention measures; disincentives involve using economic punishments (such as fines for traffic violations). These are potentially very effective when used in conjunction with one or more of the other approaches.

**Scalds and Burn Prevention:**

Children aged 0 to 5 years sustain scald burns more frequently than any other type of burn. The evidence indicates that:

- Passive interventions, such as legislation, appear to be the most effective way of preventing scald burns. Legislation proven to be effective includes: requiring safe pre-set temperatures for hot water heaters; regulating the flammability of children's sleepwear; and banning the manufacture and sale of dangerous fireworks. To optimize the effectiveness of legislation, enforcement is necessary.
- Product engineering and modifications that prevent contact with hot stoves, irons and heaters are effective in preventing burns. Child-resistant cigarette lighters and self-extinguishing cigarettes have also been shown to prevent burns and fires.
- Smoke detectors have proven to be effective and inexpensive early warning devices for reducing injuries in residential fires. Physician counselling during routine child health surveillance is an effective strategy for increasing the use of smoke detectors. There is moderate or mixed evidence for more general counselling and education on the use of smoke detectors, as well as on smoke alarm campaigns and promotion. Education on its own has not shown strong evidence of effectiveness and fire skills training has not, as yet, proven to be effective.
- There is insufficient evidence to support community-based interventions (such as coordinated, multi-strategy interventions targeted at families with children within a community), primarily because of limited research in this area.

**Poisoning Prevention:**

- Child resistant packaging has been effective in reducing unintentional childhood poisoning. Legislation governing such packaging is known to be better accepted by the public when associated with education.
- Studies on poison control centres show they have the potential to reduce medical costs associated with poisoning.

**Drowning Prevention:**

- Isolation of pools through the use of four-sided fencing has been shown to prevent unintended access to pools and therefore significantly reduces the risk of drowning.
- Evidence is limited on effective interventions to reduce alcohol-related drownings.
- Evidence on multifaceted community campaigns show positive results in the use of personal flotation devices. However, studies on boating safety courses suffer from poor design, and it is difficult to determine efficacy in this area.

**Bicycle and Pedestrian Injury Prevention:**

- Area-wide traffic calming has shown potential for reducing motor vehicle collisions and therefore for reducing motor vehicle-related injuries.



## **Unintentional Injury Prevention**

---

- Bicycle lanes may provide protection to cyclists from motor vehicles when cyclists are travelling in the same direction as the flow of traffic, but there has not been sufficient data collected to form definite conclusions.
- There is clear evidence for the effectiveness of bicycle helmets in reducing the risk of head injury, and legislation on mandatory bicycle helmet use has shown to increase helmet-wearing rates. Overall, characteristics of successful interventions to promote bicycle helmet use include: participation of parents, a broad scope including education, media announcements, bike rodeos, helmet discounts, and interventions which use a combination of legislation, regulation and increasing access to helmets through subsidies.
- There is mixed evidence of the effectiveness of community-based campaigns that promote road safety for bicyclists and pedestrians, as many interventions have not been rigorously evaluated.

### **Falls Among Children:**

The evidence indicates that playgrounds are a common source of injuries among children; a common cause of playground injury is falling from equipment. Studies have found that:

- Surfaces that use impact-absorbing materials with sufficient depth, and playground equipment that reduces fall heights, can reduce the incidence of injuries.
- Education and legislation on the use of window bars, particularly in rental housing, appears to reduce falls.
- Community-based approaches to prevent childhood injury, including falls, are commonly used approaches in preventing injury.

### **Community-based Injury Prevention Strategies:**

- There is increasing evidence emerging regarding the effectiveness of community-based injury prevention programs: however, a positive and sustained impact on injury rates has not yet been demonstrated conclusively.
- Research indicates that community-based approaches are effective at increasing some safety practices, such as bicycle helmet use and car seat use among children. Other community-based interventions are only moderately supported by the evidence, primarily because there are few studies on measurable outcomes. There is, however, some evidence that the World Health Organization's Safe Communities Model reduces injuries within populations.
- Successful interventions have included: the use of multiple strategies that promote behaviour change; strategies tailored for the specific needs of the community; and the use of community coalitions in the development and assessment of injury prevention initiatives.

### **Motor Vehicle Occupant Restraint:**

- Child motor vehicle restraint promotion programs show mixed evidence of efficacy. Programs that include incentives in conjunction with education have increased child

safety seat use over the short term. Child car seat loan programs are effective at increasing use, both for infant seats and booster seats for older children.

- There is strong evidence that enforcement of seatbelt laws and child safety seat laws are effective in increasing their use and reducing injuries and deaths.

### **Motor Vehicle Crash Prevention Among Young Drivers:<sup>1</sup>**

Motor vehicle crash (MVC)-related injury is the leading cause of death and disability among adolescents and young adults in BC. The evidence has found:

- Strong support for continued legislation and enforcement of blood-alcohol concentration limits, combined with meaningful consequences for violation of zero tolerance among learner and novice drivers.
- A minimum legal drinking age is strongly supported by the evidence—a minimum drinking age raised above age 18 has been reported to reduce MVC fatalities.
- Promising practices include: increasing awareness of vehicle crash worthiness among young drivers and their parents; continued enforcement of alcohol control (e.g., sobriety checkpoints, breath-tests etc); enforcement of mandatory seat-belt use; enforcement of passenger restrictions during learner and novice stages; and greater parental involvement, with parents being encouraged to negotiate drinking privileges with their children.
- Driver education, including school-based driver education, is not supported as a stand-alone, prevention/intervention strategy. Incentives for completing driver education should not shorten the learner period of a graduated licensing system.

### **Falls Among Youth and Adults:**

- There is clear evidence that standards addressing excavation practices, inspections and training programs in the construction field reduce injuries and deaths.

### **Falls Among Seniors:<sup>2</sup>**

- The evidence suggests that population-based falls prevention initiatives are effective and that these should form the basis of public health practice.
- A variety of specific prevention practices have proven to be effective including: multi-disciplinary, multi-factorial screening and assessment of health and environmental risk factors; environmental modifications, particularly if a senior has manual or financial help to modify their environment; clinical assessment and review of medication history to identify and reduce fall risk factors; and the use of hip protectors.
- Exercise programs are also effective, although further research is required to determine the type and effectiveness of specific programs.

---

<sup>1</sup> This summary is based on the report *Motor Vehicle Crashes Among Young Drivers: Systematic Review and Recommendations for BC*, by the BC Injury Research and Prevention Unit (Turcotte, Kinney, Joshi, & Pike, 2005).

<sup>2</sup> This summary is based on *Prevention of Falls and Injuries Among the Elderly*, by the Provincial Health Officer (2004).

### **Sports and Recreational Injury Prevention:<sup>3</sup>**

#### *Rugby*

- There is promising evidence that mouth guards, particularly those that are custom-fitted, have a preventive effect against injuries to the mouth and teeth.

#### *Soccer*

- It appears that general training and conditioning, or specific strength training programs, can help to reduce injuries among soccer players.

#### *Basketball*

- The use of ankle-stabilizing methods such as ankle braces, taping or use of high-top shoes has been shown to reduce ankle injuries among basketball players.

#### *Baseball*

- Break-away bases are more effective than standard bases, showing up to an 80 per cent reduction in the number of sliding injuries in both baseball and softball at varying levels of play.

#### *Ice Hockey*

- Mandatory head and face protection at all levels of play, and safety equipment that is properly fitted and of high standard, decreases injuries among hockey players. Strict enforcement of safety rules (e.g., high-sticking, fighting and checking from behind) is also effective in preventing injuries.

#### *Football*

- Pre-season training is associated with reductions in injuries among football players. Rule changes in 1976 regarding tackling and blocking, along with safety standards for helmets in 1978, have had an important and significant impact on injury reductions. Studies recommend that all equipment be properly fitted, well maintained and appropriate for each playing position.

#### *Skiing and Snowboarding*

- It has been clearly demonstrated that use of helmets significantly reduces the risk of head injuries.

#### *Small Wheel Vehicles*

- The use of protective equipment has proven to reduce the number and severity of injuries from riding skateboards, scooters and inline skates. Limiting the age at which a child should ride and employing close adult supervision also significantly reduces the risk of injury.

This review includes a summary of the following documents:

- *Prevention of Falls and Injuries Among the Elderly* (2004), from the Provincial Health Officer.

---

<sup>3</sup> This summary is drawn from *Sports and Recreation Injury Prevention Strategies: Systematic Review and Best Practices*, by the BC Injury Research and Prevention Unit (MacKay et al., 2001), in addition to an updated review by BCIRPU on skiing and snowboarding and small wheel vehicle injury prevention.

***Core Public Health Functions for BC: Evidence Review***  
**Unintentional Injury Prevention**

---

- *Motor Vehicle Crashes among Young Drivers: Systematic Review and Recommendations for BC* (2005), BC Injury Research and Prevention Unit (Turcotte et al., 2005).
- *Sports and Recreation Injury Prevention Strategies: Systematic Review and Best Practices* (2001), BC Injury Research and Prevention Unit (MacKay et al., 2001).

Several other reviews, which are in the final stages of completion by the BC Injury Research and Prevention Unit (BCIRPU), will provide additional important evidence. These will be available on the BCIRPU website ([www.injuryresearch.bc.ca](http://www.injuryresearch.bc.ca)) once completed:

- *Motor Vehicle-related Injuries in British Columbia.*
- *A Systematic Review of the Effectiveness of Intervention Strategies to Reduce Older Driver Involved Crashes.*
- *Injury Prevention Intervention Strategies of Among Aboriginal People: A Systematic Review.*

## **1.0 OVERVIEW/ SETTING THE CONTEXT**

In 2005, the British Columbia Ministry of Health released a policy framework to support the delivery of effective public health services. The *Framework for Core Functions in Public Health* identifies unintentional injury prevention as one of the 21 core programs that a health authority provides in a renewed and comprehensive public health system.

The process for developing performance improvement plans for each core program involves completion of an evidence review used to inform the development of a model core program paper. These resources are then utilized by the health authority in their performance improvement planning processes.

This evidence review was developed to identify the current state of the evidence based on the research literature and accepted standards that have proven to be effective, especially at the health authority level. In addition, the evidence review identifies best practices and benchmarks where this information is available.

### **1.1 An Introduction to This Paper**

Injuries are not accidents, they follow predictable patterns, are measurable, and preventable. The methodology for addressing injury consists of four levels: surveillance, risk factor identification, intervention evaluation, and program implementation.

Injury prevention initiatives can be classified into four general approaches:

- *Education* – The basic concept behind education is that the public, given information or skills training, will retain what has been taught and use it to reduce the risk of injury. Education is the most commonly used strategy in injury prevention. Education is the least effective approach when used alone but a necessary component of all interventions.
- *Enforcement/Legislation* – Enforcement involves the creation and enforcement of laws, regulations, and policies aimed at controlling injuries. These strategies are generally effective, more so when they are enforced properly.
- *Engineering/Environment* – Engineering strategies involve the development or modification of products and environments to make them safer. Generally, engineering efforts are effective.
- *Economic Incentive and Disincentives* – Economic incentives involve providing financial benefits to individuals who take specific injury prevention measures. Disincentives involve using economic punishments such as fines for traffic violations. There is a potentially very effective strategy when used in conjunction with one or more of the other approaches.

Research has shown that multi-faceted initiatives that use at least two of the above general approaches have the greatest chance of being successful in reducing the burden of injury. Although education is not shown to be very effective on its own it is an essential element for

## ***Core Public Health Functions for BC: Evidence Review*** **Unintentional Injury Prevention**

---

supporting engineering and enforcement strategies. Educating policy makers and the public usually precedes action in terms of public policy and engineering modifications.

Health authorities in BC can act as a catalyst in any of these approaches to injury prevention. For example, public health nurses can provide education, the health authority can support policy and legislative changes, and in the community the health authority can serve as a model for a safe built environment that enhances safety and reduces injury.

The primary purpose of this review is to disseminate timely prevention evidence on the major issues related to unintentional injury in British Columbia. This report will provide a summary of the current state of research (2000 to 2005) of unintentional injury prevention efforts targeting individuals, communities, and policies. The review will be one of the documents in support of the Public Health Core Functions/Programs project, lead by Dr. Trevor Hancock, BC Ministry of Health.

This review does not cover injury prevention topics related to motor vehicle collisions. These topics are addressed specifically in three separate reports: *Motor Vehicle Crashes Among Young Drivers: Systematic Review & Recommendations for BC* (Turcotte et al., 2005), *Motor Vehicle-related Injuries in British Columbia* (Desapriya, Han, Turcotte, & Pike, 2007) and *Motor Vehicle Crashes Among Older Drivers: Systematic Review*. Sport and recreation injury prevention was the subject of a systematic reviewed completed in 2001 (Mackay et al., 2001). An unintentional injury review for First Nations and a data report related to motor vehicle collisions among all ages in BC is currently underway. The evidence and data report will be made available on the BCIRPU website (<http://www.injuryresearch.bc.ca>) once completed.

A recent review by the Provincial Health Officer, *Prevention of Falls and Injuries Among the Elderly* (2004), is summarized in this review.

The topics for injury prevention that this review covers are:

- Unintentional poisoning.
- Falls.
- Bicycle and pedestrian injury.
- Drowning.
- Choking, foreign body aspiration and suffocation.
- Burns and scalds.
- Motor vehicle occupant restraint.
- Community-based strategies.
- Safety devices and home modifications.

## **1.2 Limitations**

Injury prevention is a relatively new field and not all issues have yet been covered by systematic reviews, resulting in specific strategies not being addressed in this review of systematic review. This review is limited to a review of systematic reviews and review articles, and not primary research literature. Prevention and intervention strategies that have been topics of reviews elsewhere have been included. The exception to this is for the research literature related to falls among youth and adults and poisoning among youth and adults. Evidence investigating the cost-effectiveness of strategies is limited; however, the evidence has been included in this review where available. Due to a limited number of systematic reviews and review articles for these populations and injury causes, relevant primary research literature was reviewed to assess the state of the evidence.

## **2.0 METHODOLOGY**

The implementation of proven prevention strategies to reduce the burden of injury in BC is of major public health importance. Systematic literature reviews provide valuable information based on the synthesis of existing evidence from evaluation studies (Rivara, Thompson, Beahler, & MacKenzie, 1999). This review of best practices is based on systematic reviews and review literature.

### **2.1 Search Strategy**

We searched electronic databases for review literature addressing the prevention of unintentional injury and limited to those published from 2000 to 2005. The databases searched were: MEDLINE, EMBASE, Transport, CINAHL, EBM Reviews, and the Cochrane Database of Systematic Reviews (CDSR). Search strategies were tailored for each topic and altered for different databases. Sample search strategies can be found in Appendix 2.

The following journals were hand-searched from 2000 to 2005:

- *Injury Prevention and Safety Promotion.*
- *Injury Prevention.*
- *Accident Analysis and Prevention.*

References of selected studies and relevant reviews were hand-checked to find additional studies.

Grey area literature and conference proceedings were found using the GOOGLE and GOOGLE SCHOLAR search engine and key words. The first 50 hits were scanned for relevant articles.

### **2.2 Selection of Eligible Reviews**

Eligible reviews were selected independently by two reviewers using a two-step process, first based on title and abstract, and then based on explicit inclusion/exclusion criteria. Discrepancies were resolved through discussion and third party participation.

Inclusion criteria:

- 1) Research evaluating a prevention or intervention strategy for bicycle and pedestrian injuries, burn and scald injuries, choking and aspiration, drowning, falls, or poisoning.
- 2) Study design being either a systematic review or literature review.
- 3) Study population involving children, youth, adults, seniors or all ages presented together
- 4) Study reporting at least one objective quantified outcome: injury rates; frequency of injuries; change in behaviour, attitude or knowledge; public policy; environmental safety interventions; community-based interventions; or education.

A sample inclusion/exclusion form can be found in Appendix 3.



Excluded Topics:

- Unintentional topics covered in recent reviews or planned for in future reviews.
- Intentional/Inflicted injury.
- Lead poisoning.<sup>4</sup>
- Food poisoning.<sup>4</sup>

## **2.3 Quality Assessment**

The modified Oxman Checklist for Review Articles was used for grading the quality of included reviews (Oxman, 1994; Barns & Bero, 1998). Two reviewers independently graded each paper, results were discussed, and any discrepancies that could not be resolved were discussed with a third reviewer. The modified Oxman Checklist for Review Articles quality assessment tool is available in Appendix 4.

## **2.4 Reference Articles**

Given that this systematic review is based on review articles, both primary research and review articles were found to be duplicated among the references of the included articles. References were extracted from each of the systematic reviews and review articles. Comparison of these references was made to assess if each of the selected reviews presented information from unique sources, or if duplication among references existed. Beyond duplication of evidence, it is important to realize that several studies are based on the same study data.

Evidence references appearing in this report are structured to identify either the selected systematic review or review articles (marked in bold) followed by the primary source from within each of the selected reviews.

## **2.5 Data Extraction**

Data extraction for all included articles was completed using a standardized form that records authors, year of publication, internal article reference number, modified Oxman score, studies included in review, population, intervention measured, outcomes measured, results, recommendations and recommendations for future research. A summary of results from each included systematic review and review article can be found in Appendix 5. This appendix can be used to understand specific details of each study that the systematic review results are based on.

## **2.6 Strength of the Evidence**

The strength of the evidence was determined by the conclusions made by the authors of the reviews, the number of systematic reviews and review articles contributing to the evidence, as

---

<sup>4</sup> Lead and food poisoning are not included in this review. Food poisoning is not included as it is considered a bacterial infection by the International Classification of Disease (ICD) coding system. Lead poisoning is captured in the ICD-10 diagnosis codes, not in the external codes, and is therefore considered a disease and not an injury.

## ***Core Public Health Functions for BC: Evidence Review***

### **Unintentional Injury Prevention**

---

well as the number of reference articles cited within the systematic review or review article. The evidence is rated and categorized as:

|   |  |
|---|--|
| <b>Strongly supported by the evidence</b>       | Systematic review and review articles, strong conclusions made by authors, supported by abundant primary research  |
| <b>Good Practice</b>                            | Systematic review and review articles, positive conclusions made by authors, supported by limited primary research   |
| <b>Promising Practice</b>                       | Systematic review and review articles, positive conclusions made by authors although limited by poor study design, limited primary research base, or lack of rigorous evaluation |
| <b>Limited evidence of effectiveness</b>        | Systematic review and review articles, conclusions limited by poor study design, limited primary research base, or lack of rigorous evaluation                                   |
| <b>Strong evidence of limited effectiveness</b> | Systematic review and review articles, conclusions of limited effectiveness made by authors, supported by primary research   |
| <b>Evidence of negative effects</b>             | Systematic review and review articles, strong negative conclusions made by authors, supported by primary research  |

Sections 4 through 12 introduce areas of prevention and intervention research that have been the focus of one or more systematic reviews, and may also be supported by review articles. Sections 13 and 14 are areas where systematic reviews are limited and primary research has been reviewed in addition to relevant systematic reviews. Section 15, discussing efforts for the prevention of falls and fall-related injuries among seniors, is a summary of the evidence from the Provincial Health Officer's special report, entitled *Prevention of Falls and Injuries among the Elderly* (2004).

## **2.7 Limitations**

This systematic review summarizes review literature evaluating prevention and intervention strategies for various unintentional injury issues where studies report quantifiable outcomes such as the rate or frequency of injury, changes in behaviour, attitudes, knowledge or other surrogate measures.

Due to the topic scope and time restraints this review is a review of systematic reviews and review articles. Prevention and intervention strategies that have been topics of reviews elsewhere have been included. The exception to this is for the topics of falls among youth and adults and poisoning among youth and adults. Due to limited systematic reviews and review articles for these populations and injury topics, relevant primary literature was reviewed.

### **3.0 BACKGROUND**

#### **3.1 Children and Youth**

Injury is the leading cause of death and hospitalization for children, youth, and adults (to age 44) in British Columbia (Rajabali et al., 2005). Approximately 1,200 people in BC are injured each day and of these 4 will die (Rajabali et al., 2005). In BC in 1998, a total of 423,931 preventable, unintentional injuries occurred. These injuries cost the people of BC approximately \$2.1 billion, which translates into an estimate of \$513 per British Columbian (SMARTRISK, 2001).

##### 3.1.1 Mortality Due to Unintentional Injuries

Among children and youth age 0 to 24 years from 1987 to 2000, deaths due to unintentional injuries significantly decreased for males as age increased from 0–4 years to 5–9 years, after which mortality significantly increased as age increased from 5–9 years to 20–24 years (Rajabali et al., 2005).

For females, deaths due to unintentional injuries significantly decreased as age increased from 0–4 years to 10–14 years, after which mortality significantly increased from ages 10–14 years to 15–19 years and then significantly decreased from ages 15–19 to 20–24 years (Rajabali et al., 2005).

Additionally, mortality due to injury was significantly higher among males than females from ages 5–9 to 20–24 years. The age specific mortality rates per 100,000 population and the total number of deaths between 1987 and 2000 for both males and females are presented in Table 3.1 (Rajabali et al., 2005).

**Table 3.1: Average Annual Age-Specific Mortality Rates per 100,000 and Number of Unintentional Injury Deaths, BC, 1987–2000**

| Age Group | Male              |              | Female            |              | Total             |              |
|-----------|-------------------|--------------|-------------------|--------------|-------------------|--------------|
|           | Total # of Deaths | Average Rate | Total # of Deaths | Average Rate | Total # of Deaths | Average Rate |
| 0-4       | 197               | 12.07        | 143               | 9.26         | 340               | 10.70        |
| 5-9       | 134               | 8.03         | 66                | 4.49         | 200               | 6.15         |
| 10-14     | 168               | 10.25        | 62                | 3.95         | 230               | 7.18         |
| 15-19     | 940               | 56.13        | 351               | 22.00        | 1,291             | 39.54        |
| 20-24     | 1,263             | 71.10        | 303               | 17.66        | 1,566             | 44.87        |
| 0-24      | 2,702             | 32.09        | 925               | 11.52        | 3,627             | 22.06        |

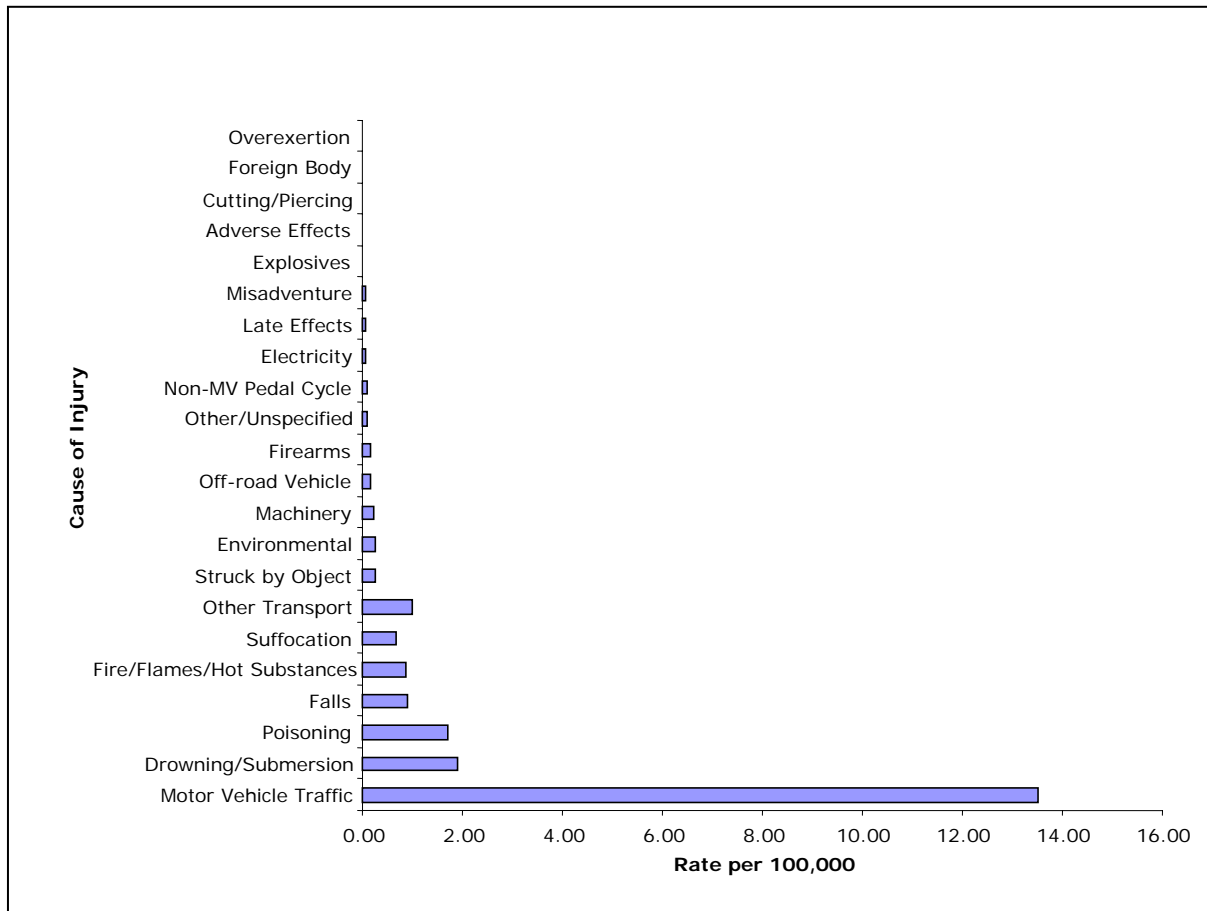
##### 3.1.2 Leading Causes of Mortality

The five leading causes of unintentional injury mortality for children and youth in BC ages 0 to 24 from 1987–2000 were (Figure 3.1):

**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

- 1) Motor Vehicle Traffic (61 per cent of all unintentional injury; 13.52 per 100,000 population).
- 2) Drowning/Submersion (9 per cent of all unintentional injury; 1.91 per 100,000 population).
- 3) Poisoning (8 per cent of all unintentional injury; 1.72 per 100,000 population).
- 4) Falls (4 per cent of all unintentional injury; 0.89 per 100,000 population).
- 5) Fire/Flames/Hot Substances (4 per cent of all unintentional injury; 0.86 per 100,000 population).

**Figure 3.1: Rates of Unintentional Injury Mortality per 100,000 Population, by Cause, Children and Youth (Age 0–24 Years), BC, 1987–2000**



**3.1.3 Hospital Separation due to Unintentional Injuries**

Table 3.2 presents the age-specific hospital separation rates per 100,000 population and the total number of injuries between 1989 and 2000 for both males and females age 0 to 24. During this time, there were 126,803 hospital separations due to unintentional injuries among children and youth. Hospital separations from unintentional injuries increased significantly for males as the

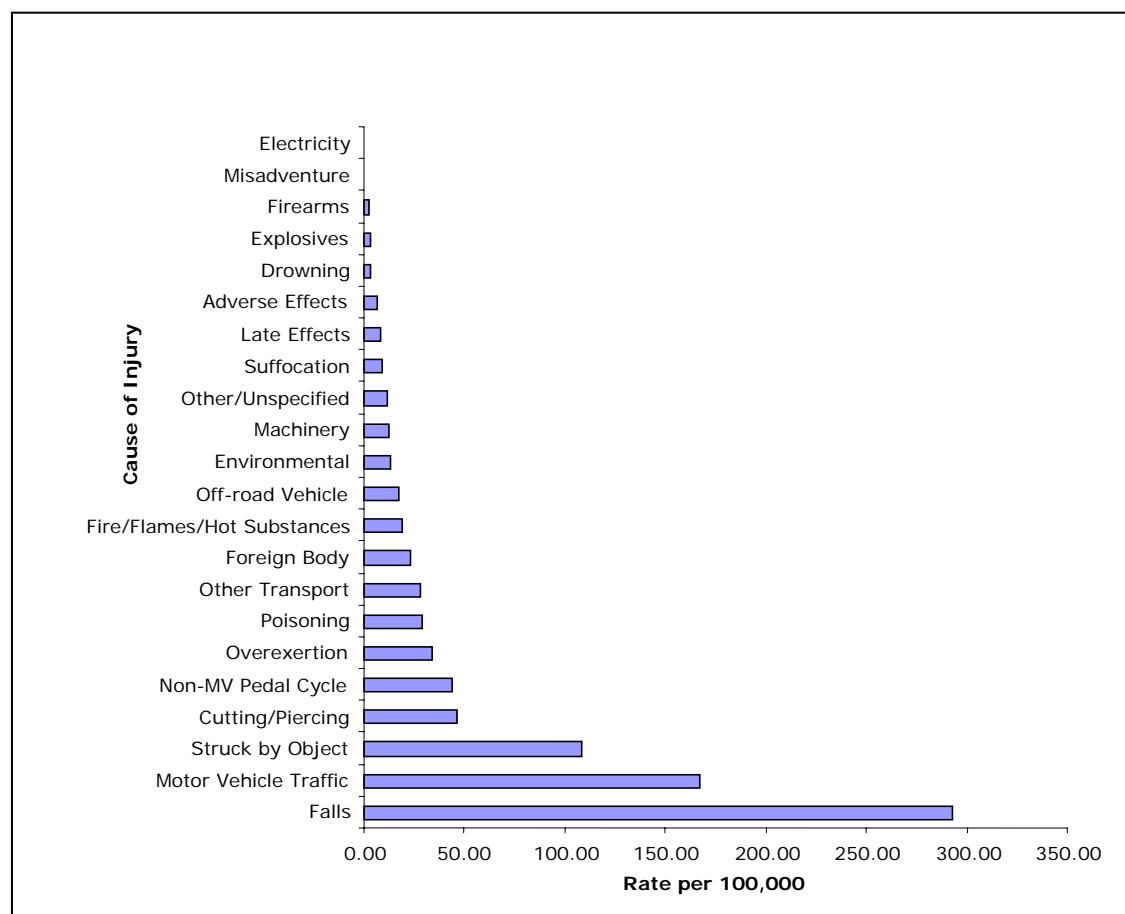
**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

age increased from 0–4 years to 15–19 years, after which injuries decreased as the ages increased from 15–19 years to 20–24 years. There was an insignificant trend observed for female hospital separations as the age groups increased. Additionally, morbidity due to injury was significantly higher among males than among females across all age groups (Rajabali et al., 2005).

**Table 3.2 Average Annual Age-Specific Hospitalization Rates per 100,000 Population and Number of Unintentional Injuries, BC, 1989–2000**

| Age Group | Male                |              | Female              |              | Total               |              |
|-----------|---------------------|--------------|---------------------|--------------|---------------------|--------------|
|           | Total # of Injuries | Average Rate | Total # of Injuries | Average Rate | Total # of Injuries | Average Rate |
| 0-4       | 10,834              | 757.62       | 7,879               | 579.42       | 18,713              | 670.76       |
| 5-9       | 12,317              | 831.33       | 8,047               | 570.84       | 20,364              | 704.41       |
| 10-14     | 16,761              | 1,143.89     | 8,003               | 577.83       | 24,764              | 868.46       |
| 15-19     | 23,290              | 1,596.52     | 9,274               | 671.66       | 32,564              | 1,146.89     |
| 20-24     | 22,758              | 1,148.03     | 7,640               | 517.44       | 30,398              | 1,011.72     |
| 0-24      | 85,960              | 1,167.58     | 40,843              | 582.52       | 126,803             | 882.27       |

**Figure 3.2: Rates of Unintentional Injury Hospitalization per 100,000 Population, by Cause, Children and Youth (Age 0–24 Years) BC, 1989–2000**



### 3.1.4 Leading Causes of Hospitalization

The five leading causes of unintentional injury hospital separation for 1989–2000 for children and youth ages 0 to 24 were:

- 1) Falls (33 per cent of all unintentional injury; 292.75 per 100,000 population).
- 2) Motor Vehicle Traffic (19 per cent of all unintentional injury; 167.42 per 100,000 population).
- 3) Struck by Object (12 per cent of all unintentional injury; 108.18 per 100,000 population).
- 4) Cutting/Piercing (5 per cent of all unintentional injury; 46.36 per 100,000 population).
- 5) Non-Motor Vehicle Pedal Cycle (5 per cent of total unintentional injury; 43.64 per 100,000 population).

## 3.2 **Adults and Seniors**

### 3.2.1 Mortality Due to Unintentional Injuries

In general, total mortality rates increased slightly with age for adults aged 25–39 years, then decreased significantly until age 64 from 1990 to 2003. After age 65, the mortality rate increased sharply with age. The rates were much higher among those aged 90+ years (Table 3.3) (Rajabali, Smith, Han, Turcotte, & Kinney, 2006).

For males, mortality rates increased slightly for adults ages 25–39; however, the rate difference among age groups 25–29, 30–34, 35–39 and 40–44 years was not significant. Rates decreased between ages 45–64 years and were also not significantly different among age groups 45–49, 50–54, 55–59 and 60–64 years (Rajabali et al., 2006).

For females, the mortality rates were not significantly different among age groups 25–29 to 60–64 years. Rates increased slightly with age among females aged 45–64; however this trend was not statistically significant (Rajabali et al., 2006).

**Table 3.3: Number of Unintentional Injuries and Rate of Injury Hospital Separations per 100,000 Population, by Age Group and Sex, BC, 1990/91–2003/04**

| Age Group | Male              |              | Female            |              | Total             |              |
|-----------|-------------------|--------------|-------------------|--------------|-------------------|--------------|
|           | Total # of Deaths | Average Rate | Total # of Deaths | Average Rate | Total # of Deaths | Average Rate |
| 25-29     | 1149              | 57.56        | 290               | 14.89        | 1439              | 36.48        |
| 30-34     | 1367              | 62.02        | 335               | 15.35        | 1702              | 38.8         |
| 35-39     | 1368              | 59.95        | 402               | 17.59        | 1770              | 38.75        |
| 40-44     | 1269              | 57.7         | 338               | 15.32        | 1607              | 36.48        |
| 45-49     | 1011              | 51.69        | 262               | 13.49        | 1273              | 32.65        |

**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

| Age Group | Male              |              | Female            |              | Total             |              |
|-----------|-------------------|--------------|-------------------|--------------|-------------------|--------------|
|           | Total # of Deaths | Average Rate | Total # of Deaths | Average Rate | Total # of Deaths | Average Rate |
| 50-54     | 696               | 43.09        | 233               | 14.62        | 929               | 28.95        |
| 55-59     | 579               | 44.53        | 209               | 16.28        | 788               | 30.49        |
| 60-64     | 414               | 36.75        | 196               | 17.42        | 610               | 27.09        |
| 65-69     | 452               | 44.97        | 261               | 24.62        | 713               | 34.52        |
| 70-74     | 439               | 52.95        | 304               | 31.28        | 743               | 41.25        |
| 75-79     | 542               | 90.59        | 479               | 59.94        | 1021              | 73.06        |
| 80-84     | 596               | 166.53       | 648               | 116.98       | 1244              | 136.43       |
| 85-89     | 522               | 317.18       | 748               | 245.2        | 1270              | 270.42       |
| 90+       | 483               | 761.82       | 972               | 615.36       | 1455              | 657.31       |
| Total     | 10887             | 131.95       | 5677              | 87.02        | 16564             | 105.91       |

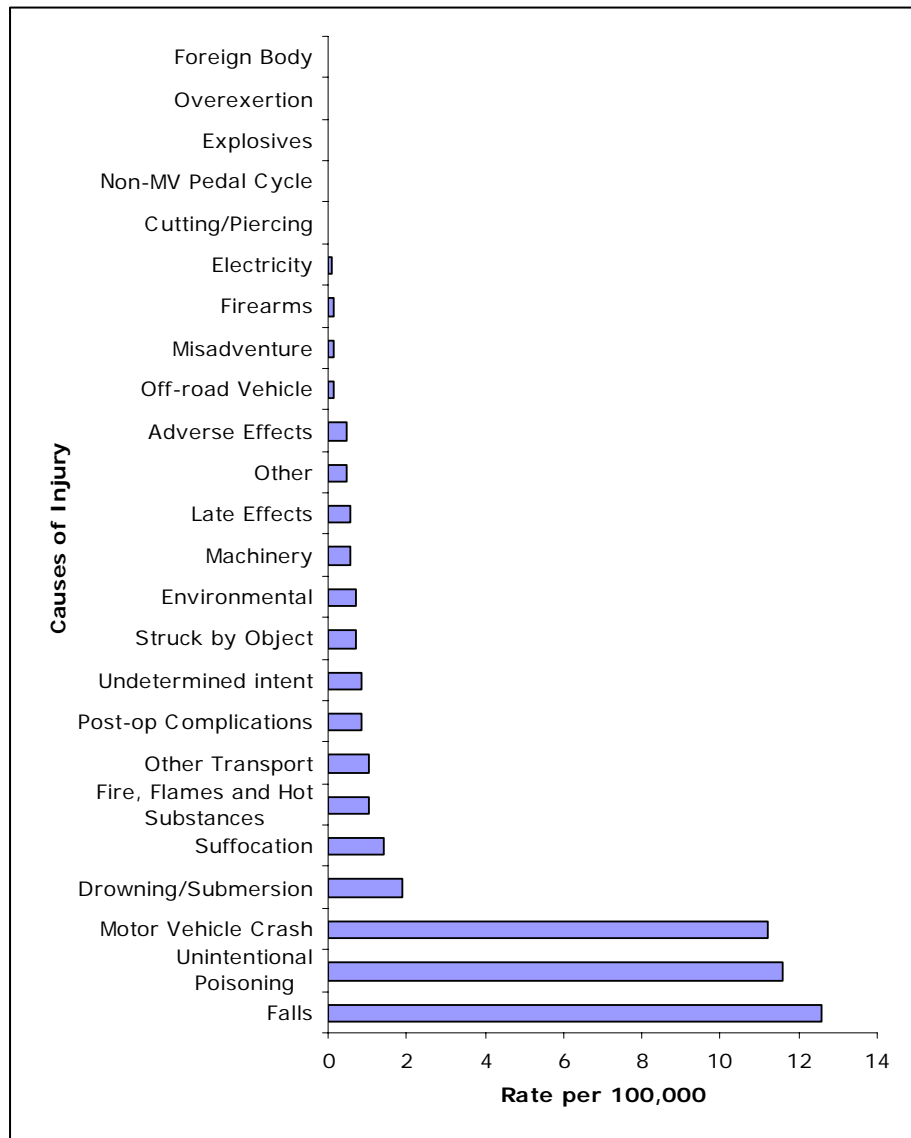
**3.2.2 Leading Causes of Mortality**

The five leading causes of unintentional injury mortality for adults in BC ages 25 and over for 1990-2003 were:

- 1) Falls (27 per cent of all unintentional injury; 12.59 per 100,000 population).
- 2) Poisoning (25 per cent of all unintentional injury; 11.57 per 100,000 population).
- 3) Motor Vehicle Crashes (MVC) (24 per cent of all unintentional injury; 11.20 per 100,000 population).
- 4) Drowning/Submersion (4 per cent of all unintentional injury; 1.91 per 100,000 population).
- 5) Suffocation (3 per cent of all unintentional injury; 1.43 per 100,000 population).

Falls were more common among ages 75–84 and 85+ years. The highest rate of mortality due to unintentional poisoning was observed among adults aged 25–44 years, and this rate decreased with age. Mortalities due to MVC were highest among seniors aged 75–84 and 85+ years (Rajabali et al., 2006).

**Figure 3.3 Rates of Unintentional Injury Mortality per 100,000 Population, by Cause, Adults (Age 25 Years and Over) BC, 1990–2003**



### 3.2.3 Hospital Separations due to Unintentional Injuries

The rate of injury hospital separations among males was significantly higher than females for all ages, except for ages 80 and over (Table 3.4) (Rajabali et al., 2006).

Injury hospital separation rates decreased slightly with age between ages 25–44 years. The lowest rate of injury hospital separations was for adults aged 40–44. After age 45, the hospital separation rates slightly increased with age until age 64 (Rajabali et al., 2006).

After age 65, the hospital separation rates increased sharply with age. Furthermore, males had higher rates than females for each age group until ages 80–84 (Rajabali et al., 2006).



**Table 3.4 Number of Unintentional Injuries and Rate of Injury Hospital Separations per 100,000 Population, by Age Group and Sex, BC, 1990/91–2003/04**

| Age Group | Male                |              | Female              |              | Total               |              |
|-----------|---------------------|--------------|---------------------|--------------|---------------------|--------------|
|           | Total # of Injuries | Average Rate | Total # of Injuries | Average Rate | Total # of Injuries | Average Rate |
| 25-29     | 33,456              | 1,676.13     | 20,272              | 1,040.56     | 53,728              | 1,362.2      |
| 30-34     | 35,801              | 1,624.14     | 24,550              | 1,124.99     | 60,351              | 1,375.82     |
| 35-39     | 36,016              | 1,578.23     | 26,794              | 1,172.08     | 62,810              | 1,374.98     |
| 40-44     | 34,986              | 1,590.9      | 27,105              | 1,228.46     | 62,091              | 1,409.38     |
| 45-49     | 31,979              | 1,635.1      | 26,688              | 1,373.79     | 58,667              | 1,504.89     |
| 50-54     | 30,887              | 1,912.24     | 25,986              | 1,631.05     | 56,873              | 1,772.61     |
| 55-59     | 31,214              | 2,400.37     | 26,074              | 2,030.85     | 57,288              | 2,216.79     |
| 60-64     | 35,047              | 3,111.35     | 28,812              | 2,561.02     | 63,859              | 2,836.35     |
| 65-69     | 40,166              | 3,996.09     | 34,960              | 3,297.61     | 75,126              | 3,637.54     |
| 70-74     | 43,170              | 5,206.97     | 42,968              | 4,420.95     | 86,138              | 4,782.79     |
| 75-79     | 39,792              | 6,651.09     | 48,400              | 6,056.18     | 88,192              | 6,310.87     |
| 80-84     | 28,158              | 7,867.76     | 43,950              | 7,934.26     | 72,108              | 7,908.16     |
| 85-89     | 15,364              | 9,335.62     | 30,912              | 10,132.99    | 46,276              | 9,853.57     |
| 90+       | 6,705               | 10,575.54    | 18,006              | 11,399.3     | 24,711              | 11,163.36    |
| Total     | 44,2741             | 4,225.82     | 425,477             | 3,957.44     | 868,218             | 4,107.81     |

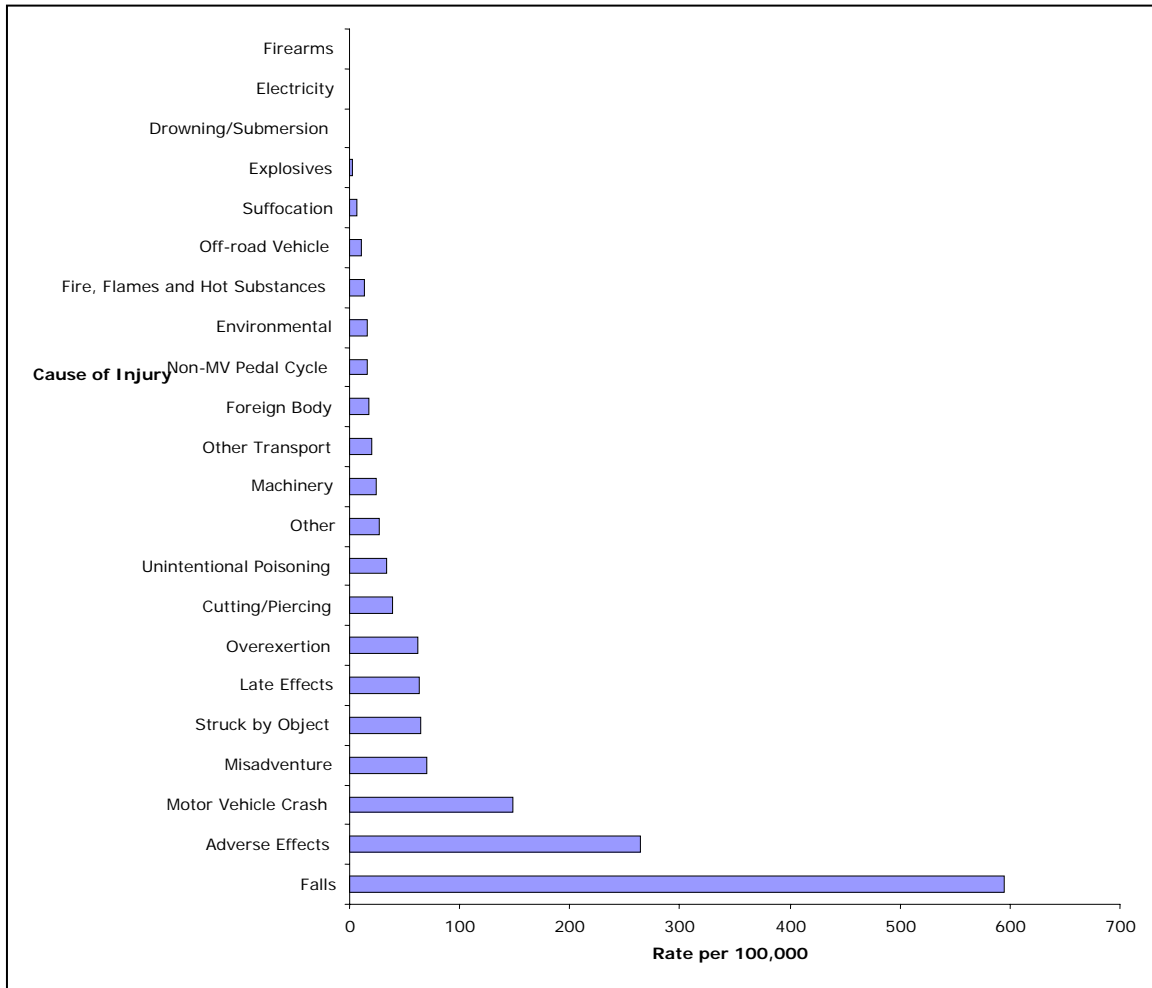
### 3.2.4 Leading Causes of Hospitalization

The five leading causes of unintentional injury hospital separation for 1990-2003 were:

- 1) Falls (40 per cent of all unintentional injury; 595.16 per 100,000 population).
- 2) Adverse Effects (17 per cent of all unintentional injury; 263.84 per 100,000 population).
- 3) MVC (6 per cent of all unintentional injury; 147.77 per 100,000 population).
- 4) Misadventure (3 per cent of all unintentional injury; 70.67 per 100,000 population).
- 5) Struck by Object (3 per cent of total unintentional injury; 64.75 per 100,000 population).

Among seniors aged 85+ years, falls were the leading cause of injury hospital separations (12,127.15 per 100,000 population). Seniors aged 75–84 had the second highest rate of injury hospital separations as a result of a fall (4741.56 per 100,000 population). As age increased, the rate of hospital separations resulting from adverse effects also increased (Rajabali et al., 2006).

**Figure 3.4 Rates of Unintentional Injury Hospitalization per 100,000 Population, by Cause, Adults (Age 25 Years and Over) BC, 1990–2003**



## 4.0 BURNS AND SCALDS PREVENTION

**Table 4.1: Reviews Included in Burns and Scalds Prevention Review**

| REVIEW   | TOPIC  | INTERVENTION   |
|--|--|--|
| DiGuseppi & Higgins, 2000<br>Modified Oxman = 0.92                                       | Smoke alarm promotion  | Education  |
| Dowswell & Towner, 2002<br>Modified Oxman = 0.92   | Primary prevention of injury among socio-economically disadvantaged children (smoke detectors) | Education  |
| Towner et al., 2001b<br>Modified Oxman = 0.92  | Smoke alarm ownership and fireworks  | Education and Enforcement/Legislation                          |
| Turner, Spinks, McClure, & Nixon, 2004<br>Modified Oxman = 0.88                          | Community-based interventions for the prevention of burns and scalds                           | Education  |
| DiGuseppi & Higgins, 2001<br>Modified Oxman = 0.86                                       | Smoke alarm ownership and function   | Education and Enforcement/Legislation                          |
| Cortes & Hargarten, 2001<br>Modified Oxman = 0.71  | Emergency department-based smoke detector education  | Education  |
| Rivara & Thompson, 2002f <sup>5</sup><br>HIPRC: Fires and Burns<br>Modified Oxman = 0.66 | Fire and burns prevention – various  | Education, Engineering/Environment and Enforcement/Legislation |
| Liao & Rossignal, 2000<br>Modified Oxman = 0.36  | Various burn prevention interventions  | Education, Engineering/Environment and Enforcement/Legislation |

### 4.1 Hot Water and Liquid Scalds

Children aged 0 to 5 years sustain scald burns more frequently than any other type of burn (Joseph, Adams, Goldfarb, & Slater, 2002). Common scald agents in early childhood are liquids, foods and bath water, and kitchens and bathrooms are the most common locations for scald burns to occur (Rajabali et al., 2005). Currently in British Columbia, legislation does not exist to regulate the temperature of hot water heaters.

#### 4.1.1 Good Practice

- Legislation requiring a safe pre-set temperature for all hot water heaters has shown to be a more effective method for reducing scald burns than education to encourage parents to turn down water heaters. Safe temperatures can be maintained by building code inspections. Legislation which outlines manufacturer’s specifications appears to be the most effective way to lower water temperature at its source. Temperatures should be enforced as a part of building code inspections of multifamily dwellings and apartments. (**Rivara & Thompson, 2002f**; Erdman, 1991).
- Scald burns from hot liquids can be prevented by modifying coffee cups and kitchen stoves. Product modification which prevents children from coming into contact with hot stoves, irons, and heaters can offer the most effective methods for reducing contact burns. Engineering approaches should be employed to design safer products and prevent hot

---

<sup>5</sup> Rivara & Thompson (HIPRC) references are from the Harborview Injury Prevention & Research Center, Best Practices available at <http://depts.washington.edu/hiprc/practices/index.html>. The primary author states that the reviews were done in 2002.

liquid spills and contact burns. (**Rivara & Thompson, 2002f**: Ytterstad & Sogaard, 1995; Elberg, 1987).

#### 4.1.2 Promising Practice

- Educational approaches are effective in some populations when combined with a tangible product to measure water temperature (i.e. liquid crystal thermometer). (**Rivara & Thompson, 2002f**: Waller, 1993; Katcher, et al., 1989; Webne, 1989; Katcher, 1987; Barone, 1984).

## 4.2 **Smoke Alarms**

Fires that are detected by smoke alarms are associated with faster discovery, lower casualty rates and less property damage and smoke alarm ownership is associated with a reduced risk of fire death (Rivara & Thompson, 2002f). Smoke alarm ownership is particularly effective in households with young children (Rivara & Thompson, 2002f).

The British Columbia provincial building code regulation 694 (1):

(l) require the installation of smoke alarms in existing buildings and other structures and, in relation to this, establish standards and specifications for required smoke alarms and their installation, to the extent that the requirements of the bylaw do not exceed those established by the Provincial building regulations;

(m) require the maintenance of smoke alarms installed as required by the Provincial building regulations or by bylaw under paragraph (l) and, in relation to this, establish standards for their maintenance

#### 4.2.1 Strongly Supported by the Evidence

- Smoke detectors are effective, reliable and inexpensive early warning devices that can reduce injuries in residential fires. (**Rivara & Thompson, 2002f**: Runyan et al., 1992) (**DiGuseppi & Higgins, 2001**: Runyan et al., 1992; Marshall, 1998, DiGuseppi, 1998a).

#### 4.2.2 Good Practice

- Stronger and statistically significant effects were observed in trials evaluating counselling in the context of routine child health surveillance. (**DiGuseppi & Higgins, 2000**: Kendrick et al., 1999; Barine, 1988; Clamp, 1998; Kelly, 1987; Thomas, 1984) (**DiGuseppi & Higgins, 2001**: Miller, 1982; LeBailly, 1990).
- Smoke detector give away programs have proven successful when targeted to high-risk areas. (**Rivara & Thompson, 2002f**: Shults et al., 1998; Mallonee et al., 1996; Gorman et al., 1985) (**Dowswell & Towner, 2002**: Fallat & Rengers, 1993; Mallonee et al., 1996; DiGuseppi et al., 1999; Harre & Coveney, 2000).

- There is evidence that smoke alarm campaigns and promotion programs (giveaways, door to door distributions, home inspections and installations in conjunction with education) lead to changes in behaviour which are sustained over time resulting in greater numbers of homes with functioning smoke alarms. (**Towner et al., 2001**: Mallonee et al., 1996; McConnell et al., 1996; Shults et al., 1998; DiGuseppi et al., 1999; King et al., 1999).

#### 4.2.3 Promising Practice

- Legislation requiring the installation of smoke detectors in new and existing housing when combined with multi-factorial community campaigns and reduced price coupons seems to be the best way to increase use. (**Rivara & Thompson, 2002f**: McLoughlin et al., 1985).
- Community trials suggest that providing free smoke alarms reduces fire-related injuries although the trials were not randomized and the effects may be exaggerated. (**DiGuseppi & Higgins, 2000**: Kendrick et al., 1999; Clamp, 1998; Miller, 1982; Klassen, 1998) (**DiGuseppi & Higgins, 2001**: Kendrick, 1999; Clamp, 1998; Thomas, 1984; Klassen 1998).

#### 4.2.4 Strong Evidence of Limited Effectiveness

- Evidence indicates that counselling or education on its own is likely to only have a modest effect on smoke alarms ownership, function, or acquisition. (**DiGuseppi & Higgins, 2000**: Barone, 1988; Clamp, 1998; Kelly, 1987; Thomas, 1984; Williams, 1988; Gielen, 1998; Jenkins, 1996) (**DiGuseppi & Higgins, 2001**: Kendrick, 1999; Barone, 1988; Clamp, 1998; Kelly, 1987; Thomas, 1984).

### **4.3 Sleepwear**

Flammability requirements for general textile products have been in effect under *The Hazardous Products Act* (HPC) since 1971 in Canada. More stringent flammability requirements for children's sleepwear that were looser fitting or more flowing (such as night gowns and robes) were developed in 1987. Enforcement actions are taken by Product Safety Officers on noncompliant products.

#### 4.3.1 Promising Practice

- Legislation regulating the flammability of sleepwear is effective in reducing burn injuries. (**Rivara & Thompson, 2002f**: Laing & Bryant, 1991; McLoughlin et al., 1986; Knudson, 1980; McLoughlin, 1977).

### **4.4 Fire Skills Training**

Skill training prepares children to react appropriately in an emergency and teaches them what actions to take when a fire breaks out.

#### 4.4.1 Limited evidence of effectiveness

- Two studies found improvement in fire safety skills following a training program using behavioural training supplemented by computer training or techniques using elaborate memory rehearsal and over learning. (**Rivara & Thompson, 2002f**: Holmes, 1986; Hillman, 1983).

### **4.5 Fireworks**

Canada allows fireworks in only two categories: family or consumer fireworks and display fireworks. Fireworks are regulated through the *Explosives Act*, which is administered by the Explosives Regulatory Division (ERD) of Natural Resources Canada. Local fire or police departments can be contacted for bylaws and regulations on discharging fireworks for municipalities in BC.

#### 4.5.1 Good Practice

- Legislation banning the manufacture and sale of dangerous fireworks combined with enforcement is the most effective way to restrict supply of fireworks. States in the United States which restrict the sale of firecrackers, bottle rockets and sparklers have one seventh the number of hospitalizations compared to states where these items are available. Legislation banning the manufacture and sale of dangerous fireworks combined with enforcement is the most effective way to restrict the supply of fireworks. Manufacture of safer fireworks is needed. (**Rivara & Thompson, 2002f**: D'Argenio et al., 1996; Sheller, 1995) (**Towner et al., 2001b**: D'Argenio et al., 1996).
- Educational campaigns are useful as supplemental efforts and can be used to build support for legislation. (**Rivara & Thompson, 2002f**: D'Argenio, 1996; Sheller, 1995).

### **4.6 Community-based Interventions**

Community-based interventions to reduce burns and scalds in children are defined as coordinated, multi-strategy initiatives targeted at families with children in an entire community or a large part of a community (Turner, Spinks et al., 2004).

#### 4.6.1 Limited evidence of effectiveness

- Despite sound methodology, the studies did not show community-based interventions to be effective in reducing burns and scalds in children. There is insufficient evidence to support the community approach to burns and scalds prevention among children. (**Turner, Spinks et al., 2004**: Guyer, 1989; MacKay 1982; Ytterstad, 1995).
- There is some data to support the effectiveness of well done community intervention programs in decreasing the rate of fires and fire/burn related injuries and death; however the strength of the evidence is weak. (**Rivara & Thompson, 2002f**: Clark, 2000; Shani, 1998; Ytterstad, 1998; Maciak, 1998; McConnell. 1996; Clark, 1992; Guyer, 1989; Gallagher, 1985; MacKay, 1982; McLoughlin, 1982; Kelly, 1987).

## **4.7 Interpretation of the Evidence and Considerations**

Passive interventions, such as legislation requiring safe pre-set temperatures for hot water heaters, appears to be the most effective way of preventing scald burns. For this intervention to be most effective, it is important that it is enforced. Legislation regulating the flammability of children's sleepwear has also shown to be effective in reducing burn injuries. Legislation banning the manufacture and sale of dangerous fireworks has been shown to be effective in reducing the supply of dangerous fireworks which may have a positive effect on reducing related injuries.

Policy and legislation play a key role in preventing injuries. The regional health authorities can assume a direct role in the development, implementation, and enforcement of local injury prevention policies, and additionally provide their position on local legislation and policy. Health authorities can support new legislation by providing educational materials that will assist in garnering public support.

Product engineering and modification that prevents contact with hot stoves, irons, and heaters has shown to be effective in preventing burns. Child-resistant cigarette lighters and self-extinguishing cigarettes are prevention strategies where technology has been developed, tested, and found to be effective in preventing fires. Health authorities could play a role in pushing for regulations requiring product modifications. This can assist in making the products available, accessible, and affordable which will impact positive uptake by the public.

Smoke detectors have proven to be effective and inexpensive early warning devices that can reduce injuries in residential fires. The issue that remains is ensuring that all buildings are equipped with functioning smoke detectors. Physician counselling during routine child health surveillance has been shown to be effective in increasing prevalence of smoke detectors while more general counselling and education has shown only moderate effects on functioning smoke detector ownership. Health authorities can equip public health physicians and nurses with education and awareness materials.

There is mixed evidence of the effectiveness of smoke alarm campaigns and promotion while education on its own has not shown strong evidence of effectiveness. Fire skills training has not as yet been shown to be effective. Community-based intervention programs have not been shown to be effective predominantly due to the lack of research studies to draw conclusions from. There is a documented need for evaluations of high quality community-based intervention programs on effective counter-measures to reduce burns and scalds (Turner, Spinks et al., 2004).

## 5.0 UNINTENTIONAL POISONING PREVENTION

**Table 5.1: Reviews Included in Poisoning Prevention Review**

| REVIEW  | TOPIC  | INTERVENTION  |
|---|--|---|
| Towner et al., 2001b<br>Modified Oxman = 0.92                         | Child-resistant packaging legislation<br>Community-based interventions | Enforcement/Legislation<br>Education                                  |
| Nixon, Spinks, Turner, & McClure, 2004<br>Modified Oxman = 0.88       | Community-based interventions  | Education   |
| Rivara & Thompson, 2002g<br>HIPRC: Poisoning<br>Modified Oxman = 0.79 | Various  | Education,<br>Engineering/Environment, and<br>Enforcement/Legislation |
| Keifer, 2000<br>Modified Oxman = 0.77                                 | Pesticide exposure prevention  | Engineering and Education   |
| Morgan & Majeed, 2004<br>Modified Oxman = 0.71                        | Restricting sales of paracetamol                                       | Enforcement/Legislation   |

### 5.1 Community-based Interventions

Community-based interventions aim to heighten awareness of poisonings, preventive measures, and appropriate course of action in an emergency situation to a broad population in a community.

#### 5.1.1 Limited Evidence of Effectiveness

- One randomized control trial shows a significant effect of community-based campaigns on the use of telephone stickers and cabinet locks although the results may not be widely applicable. (**Rivara & Thompson, 2002g**; Babouzian, 1997).
- Other studies of community-based campaigns did not show any effect on poisoning and were flawed in research design. (**Rivara & Thompson, 2002g**; Johnston, 2000; Babouzian, 1997; Rey et al., 1993; Cooper et al., 1988; Harris et al., 1979; O'Connor, 1982).
- Community-based education campaigns alone lead to no measurable reduction of poisoning in children. (**Nixon et al., 2004**; Guyer et al., 1989; Krug et al., 1994; Maisel et al., 1967; Lindqvist et al., 2002).
- A study of a mushroom poisoning prevention program disseminated to children ages 6 to 11 in schools and the community found unspecified reductions in hospitalizations and mortality and increased knowledge levels. The cultural setting of the intervention is suggested to be an important factor. (**Towner et al., 2001b**; Maliowska-Cielik & Borne, 1998).

### 5.2 Child-Resistant Packaging

Child-resistant packaging creates a barrier between harmful chemical products and a naturally curious child. In general, child-resistant packaging is required for chemical products classified in



the following sub-categories: toxic, very corrosive, corrosive and quick skin-bonding adhesive (Health Canada, 2001).

Containers which require a tool to open, such as paint cans or soup cans, are considered to be child-resistant by design. A person must not be able to gain access to the contents of the container without using a tool, and the tool must not be supplied with the container (Health Canada, 2001).

Massa & Ludemann (2004) discuss a disturbing pattern of children presenting to BC Children's Hospital in an article on paediatric caustic ingestion and parental cocaine use. Two children presented, individually and resulting from unrelated events, with dysphagia and drooling resulting from ingestion of ammonia (Massa & Ludemann, 2004). Later investigations found that the parents of the children were cocaine addicts and that the ammonia was used for freebasing cocaine (Massa & Ludemann, 2004). Neither container associated with the events had child proof caps, one bottle had a small "Danger" sign, and neither child was supervised at the time of ingestion (Massa & Ludemann, 2004).

#### 5.2.1 Good Practice

- Studies show evidence of declines in poisoning rates after passing of poison prevention packaging laws in the United States. (**Rivara & Thompson, 2002g**: Dole et al., 1986; Walton, 1982; Clarke & Walton, 1979) (**Towner et al., 2001b**: Rogers, 1996; Liller et al., 1998).
- Recent studies of the effectiveness of child-resistant packaging show that this intervention significantly reduces morbidity and mortality of childhood poisoning. (**Rivara & Thompson, 2002g**: Rogers, 1996; Assargaard & Sjoberg, 1995; Lawson et al., 1983; Howes (CPSC), 1978; Sibert et al., 1977; Done et al., 1971; Lane et al., 1971).
- Child restraint closures (CRCs) are effective in reducing poisoning in young children and community-based interventions are an effective way of implementing this countermeasure. (**Nixon et al., 2004**: Krug et a., 1994).
- Legislation requiring child-resistant packaging should be expanded to all drugs dispensed by pharmacies as well as over-the-counter medications, such as cough syrups, aspirin, and cold tablets. (**Rivara & Thompson, 2002g**).

### 5.3 **Warning Labels**

Warning labels are colourful stickers placed on containers of hazardous substances in order to warn and deter children from handling or ingesting the contents.

#### 5.3.1 Evidence of Negative Effects

- Studies showed either no effect of the intervention or an increase in children's handling of labelled medicine. It is clear that warning stickers (Mr. Yuk) are not a good deterrent for children, and may in fact serve as an attraction. Warning stickers can not be

recommended for use as a poisoning deterrent for children. (**Rivara & Thompson, 2002g**; Vernberg et al., 1984; Fergusson et al., 1982).

## **5.4 Bittering Agents**

Bittering agents are harmless additions to poisonous liquids in order to make the taste so foul and bitter that children would not continue to ingest the hazardous substance.

### **5.4.1 Limited Evidence of Effectiveness**

- A study examining an Oregon state law which requires anti-freeze and windshield washer fluid to contain an aversive agent did not provide any evidence for the impact of the law. The study had a weak design. (**Rivara & Thompson, 2002g**; Neumann et al., 2000).

## **5.5 Poison Control Centres**

A poison control centre provides poison information to the public, and is often available 24 hours. A main benefit of poison control centres is that they can provide expertise and advice to allow poisonings to be appropriately managed at home or triaged to a health care facility, and unnecessary visits to health care facilities or inappropriate or harmful home treatments can be avoided (Committee on Poison Prevention and Control [CPPC], 2004). The BC Poison Control Centre also provides drug information services to health professionals and compiles reports of adverse drug reactions.

A number of published studies exist that provide cost-benefit analyses and cost effectiveness of various aspects of poison control centres in the United States. A CPPC report suggests that when these studies are reviewed as a whole they provide convincing evidence that poison control centres save the health care system economic resources in the form of public time, lost wages, and anxiety by providing treatment management and guidance for the public (CPPC, 2004).

### **5.5.1 Promising Practice**

- Studies using cost-benefit analysis have shown that poison control centres can result in significant medical savings. An issue that remains is how well informed the public is regarding the use of poison control centres. (**Rivara & Thompson, 2002g**; Miller & Lestina, 1997).

### **5.5.2 Limited Evidence of Effectiveness**

- An education intervention initiated by the poison control centre to increase the prevalence of syrup of Ipecac, a substance that induces vomiting as a means of preventing more serious poisoning, was not shown to be successful. (**Rivara & Thompson, 2002g**; Woolf et al., 1992).

## **5.6 Drug Form**

The form of a drug, its shape and character, has been studied to investigate its role in reducing poisoning.

### **5.6.1 Limited Evidence of Effectiveness**

- The study reviewed showed that making pills unchewable and too large for young children to swallow could possibly have played a role in reducing poisonings from that particular drug. Due to poor study design, no recommendations at this time can be made regarding drug form as an intervention for preventing childhood poisoning. (**Rivara & Thompson, 2002g**; Scherz, 1968).

## **5.7 Physician-based Education**

Physician-based and pharmacy-based educational interventions are a means to access parents and children in order to increase awareness of poisonings, preventive measures, and what to do in an emergency situation.

### **5.7.1 Limited Evidence of Effectiveness**

- The studies available do not show a significant degree of efficacy of educational interventions on incidence of poisoning. (**Rivara & Thompson, 2002g**; Easton-Jones, 2000; Frankenfield et al., 1991; Dershewitz et al., 1977; Dershewitz, 1979).

## **5.8 Interpretation of the Evidence and Considerations**

Studies of child restraint closures have shown that this type of intervention is effective in reducing unintentional childhood poisonings. Health authorities can support legislation that requires child restraint closures on poisons as well as advocating for effective enforcement of enacted legislation. Legislation is known to be better accepted by the public when associated with education and health authorities can play a key role in supporting and delivering associated education as part of their public health initiatives.

Studies of poison control centres show they have the potential to reduce medical costs associated with poisonings. It is important that the public is aware of the services provided by poison control centres and health authorities can play an important role in educating the public about the services offered by poison control centres and how to access them.

## 6.0 DROWNING PREVENTION

**Table 6.1: Reviews Included in Drowning Prevention Review**

| REVIEW   | TOPIC   | INTERVENTION   |
|--|---|--|
| Thompson & Rivara, 2004<br>Modified Oxman = 0.94                     | Pool fencing  | Engineering/Environmental  |
| Rivara & Thompson, 2002d<br>HIPRC: Drowning<br>Modified Oxman = 0.79 | Various   | Education,<br>Engineering/Environmental<br>and Enforcement/Legislation |
| Driscoll, Harrison, &<br>Steenkamp, 2004<br>Modified Oxman = 0.77    | Decreasing alcohol use during<br>aquatic activities | Education and<br>Enforcement/Legislation                               |
| Brenner, Saluja, & Smith, 2003<br>Modified Oxman = 0.36              | Swimming instruction                                | Educational  |

### 6.1 Pool Fencing and Alarms

Pool fencing is a passive environmental intervention that is designed to reduce unintended access to swimming pools and therefore prevent drowning in the preschool age group. In British Columbia, safety regulations for residential pools are the responsibility of individual communities. Therefore bylaws differ from one community to the next. Enforcement of the bylaws is also the responsibility of the community.

#### 6.1.1 Strongly Supported by the Evidence

- Isolation fencing, enclosing pools on four sides, with self-latching gates is an effective intervention to reduce unintended access to pools and reduces the risk of drowning for preschool children. (**Thompson & Rivara, 2004**; Pitt, 1991; Intergovernmental, WA, 1998; Fergusson, 1984).
- Pool fencing significantly reduces the risk of drowning and isolation fencing that encloses only the pool is superior to perimeter fencing that encloses the property and the pool. (**Rivara & Thompson, 2002d**; Morgenstern et al., 2000; Pitt & Balanda, 1998; Pitt et al., 1991; Intergovernmental, WA, 1998; Present, 1987; Nixon et al., 1986; Fergusson et al., 1984; Milliner et al., 1980; Pearn et al., 1979).
- Isolation fencing is strongly recommended as an effective strategy in preventing submersion injuries. Pool fences should have a dynamic and secure gate and isolate the pool from the house (i.e. have four sided fencing). Legislation requiring fencing does increase the percentage of pools that are fenced, should require retrofitting of existing pools and include enforcement in order to be effective. (**Thompson & Rivara, 2004**; **Rivara & Thompson, 2002d**).
- Pool alarms may supplement, but are not a substitute for supervision or barriers that completely enclose swimming pools. (**Rivara & Thompson, 2002d**; MET Electrical Testing Company, 1986; Whitfield, 2000).

## **6.2 The Role of Alcohol in Drowning**

Recreational aquatic activity such as swimming and boating is commonly associated with drowning and alcohol has been suggested as a contributing factor in many drowning incidences (Driscoll et al., 2004). Violations of the *Canada Shipping Act*, which can be translated into offences under the Criminal Code of Canada, include boating while under the influence of alcohol and carries a fine no less than \$500 or up to 6 months in jail The Criminal Code of Canada.

### **6.2.1 Limited Evidence of Effectiveness**

- Proposed preventive actions to decrease the risk of alcohol related drowning during recreational activities include: public service announcements; modification or elimination of advertisements that encourage alcohol use during boating activities; restricting the sale of alcohol at aquatic facilities; legislation restricting alcohol consumption during water recreation activities; penalties for operating recreational boats under the influence of alcohol; public education; targeting high risk groups (adult males). Few suggested strategies have undergone rigorous scientific evaluation. (**Driscoll et al., 2004:** Browne et al., 2003; Bell et al., 2001; Howland & Hingson, 1988; Howland et al., 1990; Bross & Clark, 2003; Logan et al., 1994; CDC, 1988; Howland et al., 1996; Ciraula et al., 2000; CDC, 1993; Glover et al., 1995; Howland et al., 1995; Bell et al, 2000; Smith et al., 2001; Canadian Red Cross Society, 2000; Dietz & Baker, 1974; Plueckhahn, 1984; Steensberg, 1988; Browne et al., 2003; CDC, 2001; Lunetta et al., 1998; Molberg, 1993; Adams, 1966; CDC 1986; CDC, 1987; Chochinov, 1998; Fenner, 1995; Girasek, 2001; Gulaid & Sattin, 1988; Mackie, 1999; McKnight et al., 1999; Pearn, 1984; Scher, 1992; Wintemute et al., 1987).
- Campaigns that focus on decreasing alcohol use among boat operators or designated operators of boats have been criticized as drinking passengers may be at risk through the effects of alcohol on balance, judgment, swimming ability, and response to cold regardless of the sobriety of the boat operator. (**Driscoll et al., 2004:** Howland & Hingson, 1988; Howland et al., 1996; Smith et al., 2001).
- A study of minimum legal drinking age (MLDA) and blood alcohol concentration (BAC) legislation (Howland) was inconclusive. There was a strong trend in declining drowning rates over the 20-year period covered by another study (Lunetta, 1998). This suggests a decrease in submersion episodes is possibly due to a reduction in alcohol use around water. Results from both these studies evaluating the effect of alcohol legislation on drowning deaths are inconclusive. (**Rivara & Thompson, 2002d:** Howland et al., 1998; Lunetta, 1998).

## **6.3 Swimming Lessons**

A preventive strategy that may be beneficial for people of all ages is increased swimming ability through swimming instruction (Brenner et al., 2003).

### 6.3.1 Limited Evidence of Effectiveness

- There is strong evidence that swimming lessons improve swimming performance although no studies exist that show whether swimming lessons actually prevent drownings and near-drownings. (**Rivara & Thompson, 2002d**: Erbaugh, 1978; Asher et al., 1995; Erbaugh, 1986; Bentham, 1970).
- A clear protective relationship between increased swimming ability and risk of drowning has not been demonstrated. (**Brenner et al., 2003**: Waller, 1985; Schmidt, 1999; Pearn et al., 1976; Pearn & Nixon, 1977; Patrick et al., 1979; Hassall, 1989; Ozanne-Smith & Wigglesworth, 2002; Smith & Howland, 1999; Schurman et al., 1977; Gilchrist et al., 2000; Rogers, 1989; Nixon et al., 1979; Parker & Blanksby, 1997; Erbaugh, 1986; Asher, 1995; Brenner et al., 1994).

## **6.4 Boating Safety Education**

All operators of a personal water craft in Canada must have proof of competency since September 15, 2002. All operators born after April 1, 1983 must have proof of competency on board (Office of Boating Safety). Information on the Competency of Operators of Pleasure Craft Regulations is available on the Transport Canada Boating Safety website.

In Canada, an approved personal flotation device (PFD) or lifejacket of appropriate size for each person on board is part of required items and mandatory safety equipment requirements (Office of Boating Safety).

Under the new *Contraventions Act*, enforcement agencies in many provinces can now ticket offenders on the spot rather than requiring them to appear in court. Tickets can be issued for not having the required safety equipment, or violating speed limits. The following provinces are using this system: New Brunswick, Prince Edward Island, Ontario, Nova Scotia, Quebec, and Manitoba. Negotiations are ongoing with the remaining provinces and territories for implementation of the Act.

### 6.4.1 Limited Evidence of Effectiveness

- There is some evidence that a boating safety course sanctioned by the National Association of State Boating Law Administrators, in the United States, may prevent some boating incidents, but due to current study designs, evidence of a true association cannot be ascertained. (**Rivara & Thompson, 2002d**: Bernard et al, 1994).
- A cohort study of Alaskan commercial fishermen, which included some youths and young adults, had a strong design and linked individuals who had taken the Alaskan Marine Safety Education Association (AMSEA) training course to boating incidents. The evaluation showed the training to be effective but the cohort was too small to make conclusions of its effectiveness. (**Rivara & Thompson, 2002d**: Perkins, 1995).
- There is some evidence that a multifaceted community campaign can successfully increase PFD use. (**Rivara & Thompson, 2002d**: Treser, 1997).

## **6.5 Interpretation of the Evidence and Considerations**

Isolation of pools through four sided fencing has been shown to prevent unintended access to pools and therefore significantly reduce the risk of drowning. Health authorities can play an advocacy role by supporting local bylaws that require isolation fencing for pools. In the development of local bylaws, health authorities can play a role in pushing for adequate enforcement of the bylaws.

Evidence is limited addressing effective interventions to reduce alcohol-related drownings. Health authorities in British Columbia can play a role in developing the evidence base by supporting intervention strategies and ensuring that evaluations of the interventions are completed.

Evidence exists that shows swimming lessons can improve swimming performance. What is yet to be determined is if swimming ability is a protective factor for drowning. In the absence of that data, water safety lessons that include personal safety and survival skills training, in addition to swimming skills training are advisable. Health authorities can promote *water safety* lessons as part of their public health initiatives?

A study of a multifaceted community campaign showed positive results in PFD use. Health authorities in BC can support community efforts for campaigns to promote PFD use.

Studies of boating safety courses also suffer from poor design and it is difficult to determine efficacy as a result. Health authorities can support the federal regulations for personal water craft operator's competency, effective enforcement of the Canada Shipping Act in relation to boating while under the influence of alcohol, and the need for rigorous evaluations of the program to assist in determining its efficacy.

## 7.0 BICYCLE AND PEDESTRIAN INJURY PREVENTION

**Table 7.1: Reviews Included in Bicycle and Pedestrian Injury Prevention Review**

| <b>REVIEW</b>  | <b>TOPIC</b>   | <b>INTERVENTION</b>  |
|--|--|--|
| Royal, Kendrick, & Coleman, 2005<br>Modified Oxman = 1.0                     | Non-legislative interventions for promoting bicycle helmet use   | Education  |
| Bunn et al., 2003a<br>Modified Oxman = 1.0                                   | Area-wide traffic calming  | Engineering/Environmental  |
| Bunn et al., 2003b<br>Modified Oxman = 1.0                                   | Area-wide traffic calming  | Engineering/Environmental  |
| Duperrex, Roberts, & Bunn, 2002<br>Modified Oxman = 1.0                      | Pedestrian safety education programs   | Education  |
| Karkhaneh, Kalenga, Hagel, & Rowe, 2006<br>Modified Oxman = 0.96             | Bicycle helmet legislation   | Enforcement/Legislation  |
| Spinks, Turner, McClure, Action, & Nixon, 2005<br>Modified Oxman = 0.94      | Community-based programs to promote bicycle helmet use   | Education  |
| Klassen, MacKay, Moher, Walker, & Jones, 2000<br>Modified Oxman = 0.92       | Community-based education programs for child pedestrian safety and to increase the use of bicycle helmets among children | Education  |
| Dowswell & Towner, 2002<br>Modified Oxman = 0.92                             | Primary prevention of injury among socio-economically disadvantaged children   | Engineering/Environmental  |
| Towner et al., 2001a<br>Modified Oxman = 0.92                                | Primary prevention of injury among children: traffic calming   | Education and Engineering/Environmental                          |
| Turner, McClure, Nixon, & Spinks, 2004<br>Modified Oxman = 0.88              | Community-based intervention for the prevention of pedestrian injuries   | Education  |
| Pilkington & Kinra, 2005<br>Modified Oxman = 0.82                            | Speed cameras for preventing road traffic collisions   | Engineering/Environmental  |
| Rivara & Thompson, 2002b<br>HIPRC: Child Pedestrian<br>Modified Oxman = 0.79 | Various  | Education, Engineering/Environmental and Enforcement/Legislation |
| Rivara & Thompson, 2002a<br>HIPRC: Bicycles<br>Modified Oxman = 0.79         | Various  | Education, Engineering/Environmental and Enforcement/Legislation |
| Attewell, Glase, & McFadden, 2001<br>Modified Oxman = 0.73                   | Bicycle helmets  | Engineering/Environmental  |
| Kwan & Mapstone, 2002<br>Modified Oxman = 0.73                               | Visibility aids  | Engineering/Environmental  |
| Thompson, Rivara, & Thompson, 1999<br>Modified Oxman = 0.71                  | Bicycle helmets  | Engineering/Environmental  |



| REVIEW  | TOPIC              | INTERVENTION                           |
|---|--------------------|--|
| Chapman & Curran, 2004<br>Modified Oxman = 0.56 | Bicycle helmets    | Education and Enforcement/Legislation  |
| Coffman, 2003<br>Modified Oxman = 0.50          | Bicycle helmet use | Education and Enforcement /Legislation |

## 7.1 Traffic Calming

Area-wide traffic calming schemes aim to discourage through traffic on residential roads and create a safer road environment. Alterations to the road layout, road hierarchy and environment such as road humps, speed cushions, raised crosswalks, mini-roundabouts, road narrowing, rumble areas, one-way streets, four-way stops and increased vegetation are examples of traffic calming schemes.

### 7.1.1 Good Practice

- Area-wide traffic calming appears to be a promising intervention for reducing traffic injuries and deaths among all road users, including pedestrians and bicyclists, in towns and cities although further rigorous evaluation is required before a more conclusive recommendation can be made. (**Bunn et al., 2003a:** Brilon & Blanke, 1990; Kahrman, 1988; Blanke, 1993; Brilon & Blanke, 1993; Goos, 1978; Janssen 1991; Janssen, 1985; Janssen, 1984; Janssen, 1980; Janssen, 1991; Janssen et al., 1985; Janssen, 1989; Kraay & Bakker, 1984; Kraay & Remerie, 1980; Dalby, 1981; Fairlie, no date; Fairlie & Taylor, 1990; Mackie, 1988; Walker & McFetridge, 1989; Ward et al., 1989; Walker et al., 1989) (**Bunn et al., 2003b:** Blanke, 1993; Brilon no date; Brilon 1993; Dalby 1981; Fairlie & Taylor, 1990; Janssen 1991; Kahrman, 1988; Walker & McFetridge, 1989; Ward et al., 1989; Walker et al., 1989; Ward et al., 1989; Ward et al., 1989).
- One study evaluated the effect of area-wide environmental change on traffic speeds and cyclists and pedestrian injuries and can strengthen the evidence of the value of urban safety schemes. (**Towner et al., 2001a:** Webster & Mackie, 1996).
- Traffic calming appears to be a promising intervention for reducing injuries. (**Rivara & Thompson, 2002b:** Hyden, 2000; Garder, 1998; Webster, 1996; Mackie, 1998; Schnull, 1992; Box, 1989; Engel & Thomsen, 1992; Van Houten & Malenfant, 1992; Vis et al., 1992; Garder, 1989).

## 7.2 Speed Cameras

Speed cameras use radar signals generate photographic evidence of vehicles violating speed limits. Unsafe speed is generally acknowledged as a major contributor to traffic collisions in BC (Chen, Meckle, & Wilson, 2002). In response to the unsafe speed problem, identified by police, the Insurance Corporation of British Columbia (ICBC) introduced the photo radar program (PRP) in 1996 with a goal of reducing mean traffic speeds on roads throughout the province by 3 per cent. The photo radar program ended in BC in 2001.

### 7.2.1 Promising Practice

- Research consistently shows the effectiveness of speed cameras in preventing road traffic collisions and injuries, including those involving pedestrians and bicyclists. However, the level of evidence is relatively poor, and better data needs to be collected to improve the evidence base. (**Pilkington & Kinra, 2005:** Highways Agency, 1997; Chen et al., 2002; Tay, 2000; Chrisite et al., 2003; Cameron et al., 1992; Diamantopoulou & Cameron, 2002; Department for Transport, 2003; Bourne & Cooke, 1993; Chen et al., 2000; Mara et al., 1996; Hooke et al., 1996; Hook, 1995; Hess, 2003).

## **7.3 Community-based Interventions**

Community-based programs use a combination of social and physical environmental interventions in the context of community-directed activity. The community context of the way people use roads suggests that a community-focused intervention might be effective in managing the risk factors for pedestrian injury.

### 7.3.1 Promising Practice

- There are limited research studies on the effectiveness of community-based programs to prevent childhood pedestrian injuries although existing studies appear to show that interventions are effective in reducing childhood pedestrian injuries. (**Turner, McClure et al., 2004:** Stevenson, 1999; Durkin, 1999; Preusser, 1988; Ytterstad, 1995).
- Community intervention campaigns have taken a number of forms and few have been evaluated. (**Rivara & Thompson, 2002b:** Cross, 2000; Stevenson, 1999; Durkin, 1999; Ytterstad, 1995; Malenfant & Van Houten, 1989; Blomberg et al., 1983; Thackray, 1982).
- Community-based interventions to promote the use of bicycle helmets among children were reviewed and all resulted in some improvement in wearing rates but none could isolate the effectiveness of each intervention, making it impossible to determine precisely what influenced the wearing rate. Successful changes in whole communities have been reported on but each community may have used a different mix of intervention components. These studies all demonstrate the ability of community interventions to improve helmet wearing in the child population, at least in the short term. (**Spinks et al., 2005:** DiGuseppi et al., 1989; Bergman et al., 1990; Rivara et al., 1994; Cote et al., 1992; Macknin & Mendenthorp, 1994; Rourke, 1994; Farley et al., 1996; Ekman et al., 1997; Lee et al., 2000; Vulcan et al., 1992; McDermott, 1995; Rouzier & Alto, 1995; Durkin et al., 1990; Gilchrist et al., 2000; Wesson et al., 2000; Liller et al., 1995).
- Both survey and observational studies documented increased helmet use after widespread community campaigns. Single isolated interventions had limited or no effect. The effectiveness of limited interventions tended to decrease over time. (**Coffman, 2003:** Borgland et al., 1999; Britt et al., 1998; Caplow & Runyan, 1995; Floerchinger-Franks et al., 2000; Gilchrist et al., 2000; Hatziandreu et al., 1995; Kim et al., 1997; Lee et al., 2000; Liller et al., 1995; Mock et al., 1995; Mosiman et al., 1995; Parkin et al., 1995;

Puder et al., 1999; Seijts et al., 1995; Shafi et al., 1998; Tenn et al., 1996; Ekman, 1997; Scuffham et al., 2000; Shafi et al., 1998).

- There is good evidence to suggest that community-based helmet promotion programs that include free helmet provision are effective in increasing helmet use in children. Programs including subsidized helmets and those in other settings may also be effective but the evidence is not as strong. (**Royal et al., 2005:** Britt, 1998; Cote, 1992; Cushman, 1991a; Cushman 1991b; DiGuseppi, 1989; Farley, 1996; Floerchinger, 2000; Hendrickson, 1998; Kim, 1997; Lee, 2000; Liller 1995; Macarthur, 1998; Moore, 1990; Morris, 1991; Parkin 1993; Parkin 1995; Pendergrast, 1992; Quine, 2001; Stutts, 1990; Towner, 1992; Watts, 1997; Wright, 1995).
- Results indicate that community-based education to improve traffic safety behaviour among children is limited. Interventions delivered in simulated settings show no evidence that children will behave in the same manner in real-life settings. (**Klassen et al., 2000:** West 1993; Rothengatter, 1984; Renaud, 1989; Nishioka, 1991; Davidson, 1994; Svanstrom 1995; Schlesinger, 1997; Sundelin, 1996).

## **7.4 Road Safety Skills Training**

An approach for preventing bicycle-related injuries through skills training can include education programs to improve riding behaviour and safety. Pedestrian education teaches traffic environment coping skills. Education aims to enhance pedestrian knowledge, attitudes and behaviour to prevent pedestrian injury.

### **7.4.1 Promising Practice**

- The studies reviewed were unable to demonstrate a positive effect of bicycle skills training for changes in observed cycling behaviour or reduction in injuries. (**Rivara & Thompson, 2002a:** Macarthur, 1998; Carlin, 1998; Savill et al., 1996).
- New literature shows that there is increased, but still limited, evidence that bicycle training schemes can improve safe riding behaviour and that education on safe bus boarding can achieve positive results. Thomas & Whelan's study suggest that children's behaviour for road crossing can be improved by extensive roadside training. (**Towner et al., 2001a:** Hazinski et al., 1995; Burke et al., 1996; Savil et al., 1996; Thomas & Whelan, 1997; Macarthur et al., 1998).
- Pedestrian safety education can result in improvement in children's knowledge and can change observed road crossing behaviour, but whether this reduces the risk of pedestrian motor vehicle collision and injury occurrence is unknown. (**Duperrex et al., 2002:** Ampofo-Boateng, 1993; Bouck, 1992; Cross 1988; Downing 1981; Limbourg 1981; Luria, 2000; Matson, 1980; Miller, 1982; Nishioka, 1991; Renaud, 1989; Singh, 1979; Thomson, 1992; Thomson, 1997a; Thomson, 1997b; Thomson, 1998).

## **7.5 Bicycle Helmet Effectiveness**

Head injury is a substantial risk to bicyclists and while it seems obvious that wearing a bicycle helmet would protect against head injury in a crash situation it is important that the effectiveness of helmets is established.

### **7.5.1 Strong Evidence of Effectiveness**

- All studies showed consistent data indicating that wearing an industry-approved bicycle helmet will significantly reduce the risk of head injury. (**Rivara & Thompson, 2002a:** Attewell, 2001; Kelsch, 1996; Finvers, 1996; Acton, 1996; Thomspson et al., 1996; Maimaris et al., 1994; Thomas et al., 1994; McDermott et al., 1993; Spaite et al., 1991; Thompson et al., 1990; Thomspson et al., 1989).
- Results provide clear evidence for the benefit of wearing helmets while cycling in terms of risk reduction for not only head and brain injury, but also facial injury and fatal injury. These results are applicable to riders of all ages, both in less severe crashes and in collisions with motor vehicles. (**Attewell et al., 2001:** Dorsch et al., 1987; Wasserman et al., 1988; Thompson et al., 1989; Thomspson et al., 1990; Wasserman & Buccini, 1990; Spaite et al., 1991; McDermott et al., 1993; Maimaris et al., 1994; Thomas et al., 1994; Finvers et al., 1994; Thompson et al., 1996a; Thomspson et al., 1996b; Rivara et al., 1997; Jacobson et al., 1998; Linn et al., 1998; Shafi et al., 1998).
- This review identified five well conducted case-control studies; no randomized control trials were found. Helmets provide a 63 to 88 per cent reduction in the risk of head, brain, and severe injury for all ages of bicyclists. Helmets provide equal levels of protection for crashes involving motor vehicles (69 per cent) and crashes from all other causes (68 per cent). Injuries to the upper and mid facial areas are reduced 65 per cent. (**Thompson, 1999:** Maimaris, 1994; McDermott, 1993; Thomas, 1994; Thompson, 1989; Thompson, 1990; Thompson, 1996a; Thompson 1996b).
- The wearing of bicycle helmets contributes significantly to the prevention of head injuries and traumatic brain injury particularly in children and adolescents. There is evidence to support the role of cycle helmets in the prevention of injuries to the middle third of the face and some dental injuries. (**Chapman & Curran, 2004:** Attewell et al., 2001; Thompson et al., 2001).

## **7.6 Bicycle Helmet Legislation**

To address the low level of bicycle helmet wearing rates in British Columbia, the province became the first in Canada to enact a law mandating helmet use by all bicyclists of all ages when riding on a public roadway in 1996 (Foss & Beirness, 2000).

A study of the effectiveness of the bicycle helmet law in BC, Foss & Beirness (2000) found that helmet use increased markedly between 1995, prior to the law taking effect and 1999, nearly three years after the law was enacted.

### 7.6.1 Good Practice

- There is a case for the implementation of legislation accompanied by educational campaigns to increase significantly the use of cycle helmets. (**Chapman & Curran, 2004**: Lee et al., 2000; Quine et al., 2001; McDermott, 1995; Scuffham & Langely, 1997; Cycle Helmets, 1999; Caplow & Runyan, 1995; Robinson, 1996; Ni et al., 1997).
- Legislative programs were found to be more cost effective than community campaigns to promote wearing bicycle helmets. Laws that were more comprehensive or more strictly enforced resulted in increased helmet wearing rates. Researchers have documented reductions in head injuries, decreased inpatient admissions, and lower injury severity scores in helmeted children after legislation took effect. (**Coffman, 2003**: Seijts et al., 1995; Hatziandreu et al., 1995; Shafi et al., 1998; Puder et al., 1999).
- Legislation can achieve positive effects on bicycle helmet wearing behaviour. (**Towner et al., 2001a**: Abularrage, 1997; Ni et al., 1997).
- Available studies show that legislation substantially increases helmet use. Studies of bicycle helmet legislation may show less impressive results where baseline rates are already high; however the intervention still has merit in these settings and should not be abandoned. (**Karkhanaeh et al., 2006**: Cote, 1992; Cameron, 1994; Ni, 1997; Foss, 2000; Kanny, 2001; LeBlanc, 2002; Thomas, 2002; Delamater, 2003; Liller, 2003; Parkin, 2003; Hagel, 2005; Povey, 2005).

## **7.7 Education to Increase Bicycle Helmet Use**

Education to increase the use of bicycle helmets is popular and can be in the form of community-based, school-based, physician-based or in a combination of settings. Bicycle helmet education can aim to increase the use of helmets among bicyclists and may be employed in combination with incentives such as helmet subsidies or give-a-ways.

### 7.7.1 Promising Practice

- Interventions based on increasing helmet use through education have been successful when done properly. An important element of intervention programs is the participation of parents. The most effective education interventions have a broad scope that includes media announcements, bike rodeos, and helmet discounts. Helmet subsidies are effective among low socio-economic children. Injury prevention strategies that have produced the best results have used a combination of education with legislation, regulation, or lowering barriers to implementation. Successful programs have usually been narrowly focused on single issues and have offered specific interventions. Economic incentives are important and have been a part of many successful helmet campaigns. (**Rivara & Thompson, 2002a**: Cook & Sheikh, 2000; Floerchinger, 2000; Wesson, 2000; Durkin, 1999; Britt, 1998; Logan, 1998; Abularrage, 1997; Ekman, 1997; Mock, 1995; Rouzier, 1995; Wright, 1995; Farley et al., 1996; Jaffe et al., 1996; Hatziandreu et al., 1995; Liller et al., 1995; Parkin et al., 1995; Morris et al., 1994; Rivara et al., 1994; Rourke, 1994; Dannenberg et al., 1993; Parkin et al., 1993; Towner et al., 1992; Morris et al., 1991;

Bergman et al., 1990; Stutts et al., 1990; DiGuiseppi et al., 1989; Wood & Milne, 1988; Bercham et al., 1987) (**Dowswell & Towner, 2002**: Puczynski & Marshall, 1992; Parkin et al., 1993; Parkin et al., 1995; Farley et al., 1996; Britt et al., 1998; Hendrickson & Becker, 1998) (**Towner et al., 2001a**: Mock et al, 1995; Parkin et al., 1995; Farley et al, 1996; Ekman et al., 1997; Kim et al., 1997; Britt et al., 1998; Hendrickson & Becker, 1998; Logan et al., 1998).

- Helmet education interventions should be based on research data, focus on a carefully selected target age group, include the use of a bicycle helmet subsidy (through discounts or donation) in addition to other tactics, and have a built-in evaluation component. (**Rivara & Thompson, 2002a**).
- Results from studies indicate that community-based programs can increase bicycle helmet use among children. To increase the likelihood of success, efforts should be targeted to increase parent's awareness of the importance of bicycle helmet use, educate children to overcome resistance to helmet use, subsidize helmet costs, and pass regional legislation enforcing bicycle helmet use. (**Klassen et al., 2000**: Morris, 1991; Towner, 1992; Cote, 1992; Dannenberg, 1994; DiGuiseppi, 1989; Parkin, 1993; Parkin, 1995; Farley, 1996; Liller, 1995; Moore, 1990; Ekman, 1997; Tenn, 1996)

## **7.8 Bicycle Lanes**

Bicycle lanes are portions of the roadway designated for bicyclists and provide a buffer zone between bicyclists and other road traffic.

### **7.8.1 Promising Practice**

- The studies reviewed present some evidence that bicycle lanes may provide protection against bicycle related motor vehicle collisions although the conclusions reached are speculative. Evidence also indicates that riding with the flow of traffic reduces one's chance of collision with motor vehicles. There are some preliminary data indicating that bicycle paths may have an impact on incident rates, but no conclusions can be reached until data collection and analysis are complete. (**Rivara & Thompson, 2002a**: Wachtel et al., 1994; Lott & Lott, 1976).
- Where bicycle lanes exist, riding should be restricted to the direction of motor vehicle travel. Paved riding surfaces should be mandatory for bicycle lanes, as well as a wide buffer zone (preferably >2.0 meters) between motor vehicle traffic and bicyclists, increasing in proportion to the speed of traffic. (**Rivara & Thompson, 2002a**).

## **7.9 Daylight Savings Time**

Pedestrian injuries are more likely to occur in the dark than in the light and researchers have investigated the impact of daylight savings time on pedestrian injury rates.

### 7.9.1 Limited Evidence of Effectiveness

- Two studies on daylight saving times both indicate a positive effect on pedestrian injury rates. (**Rivara & Thompson, 2002b**; Whittaker, 1996; Ferguson et al., 1995).
- Consideration could be given to extending hours of daylight savings time in the fall, especially in northern cities. (**Rivara & Thompson, 2002b**).

## **7.10 Visibility Aids, Lights and Reflective Clothing**

Late detection has been cited as a cause of collisions between cyclists and other road users (Kwan & Mapstone, 2002). Visibility aids such as bright clothing, lights and reflectors can increase visibility and may have the potential to reduce injuries among bicyclists.

### 7.10.1 Limited Evidence of Effectiveness

- The single study of retro-reflective clothing indicates little effect when the driver does not anticipate the pedestrian, which would be the norm state of affairs. (**Rivara & Thompson, 2002b**; Shinar, 1985).
- Visibility aids have the potential to increase conspicuity and may enable drivers to detect and recognize earlier those pedestrian and cyclists who use those aids and merit further development to gain public acceptance. However, the impact of visibility aids on pedestrian and cyclist safety is unknown and needs to be determined. (**Kwan & Mapstone, 2002**; Allen et al., 1970; Blomberg, 1986; Burg, 1978; Cole, 1984; CPSC, 1997; Hanson, 1963; Hughes 1986; Johansson 1963; Kumagai, 1999; Luoma, 1996; Luoma, 1998; Marsh, 1998; Matthews, 1980; Michon, 1969; Moberley, 2001; Muttart, 2000; Owens, 1994; Sator, 1978; Sayer, 1998; Sayer, 1999; Shinar, 1984; Shinar, 1985; Turner, 1997; Watts, 1980; Watts, 1984a; Watts, 1984b; Zwahlen, 1991; Zwahlen, 1994; Zwahlen, 1997).
- It remains unclear whether an intervention to promote cycle lights can be effective, not to mention the actual effectiveness of cycle lights themselves. Interventions regarding riding behaviour seem to be effective only in the short term. (**Rivara & Thompson, 2002a**; Ferguson et al., 1991).

## **7.11 Vehicle Modifications**

Changes in vehicle design, such as daytime running lights, curvature of vehicle corners, and other safety standards have been studied to evaluate effects on pedestrian injury rates.

### 7.11.1 Promising Practice

- Modifications, such as design changes to smooth front ends and regulations and standards for vehicles for pedestrian safety, appear to reduce the risk of pedestrian fatalities. Mandatory or automatic daytime running lights appear to have no effect. (**Rivara & Thompson, 2002b**; Robertson, 1990; Robertson, 1981).

## **7.12 Interpretation of the Evidence and Considerations**

Studies of area-wide traffic calming have shown potential for reducing motor vehicle collisions and therefore reducing motor vehicle related injuries. Health authorities can support local initiatives for area wide traffic calming as a promising strategy to reduce pedestrian and bicyclist injury and to create safer street environments. Bicycle lanes may provide protection to cyclists from motor vehicles, when cyclists are travelling in the same direction as the flow of traffic, but there has not been sufficient data collected to form a definite conclusion.

Studies of speed camera programs have shown that they are effective in reducing collisions and injuries, not only among vehicles but also those involving pedestrians and bicyclists, but the level of evidence is poor. The collection of better data would assist in more conclusively determining the efficacy of these programs.

There is clear evidence for the effectiveness of bicycle helmets to reduce the risk of head injury; therefore it is important to find effective ways to encourage cyclists to wear bicycle helmets. Legislation of mandatory bicycle helmet use has shown to increase helmet wearing rates. Health authorities can take an advocacy role in pushing for more effective enforcement of the provincial bicycle helmet law, and could be a key catalyst in helmet provision programs.

There is mixed evidence of the effectiveness of community-based campaigns that promote road safety for bicyclists and pedestrians. Many interventions have not been rigorously evaluated. Characteristics of successful interventions to promote bicycle helmet use include: participation of parents, a broad scope including education, media announcements, bike rodeos, and helmet discounts, and those interventions that use a combination of legislation, regulation, and increasing access to helmets through subsidies. Health authorities can support local initiatives that incorporate these successful strategies into bicycle helmet promotion campaigns. Support from health authorities can come in the form of resources, expertise, and infrastructure.



## **8.0 SUFFOCATION, ASPHYXIATION, FOREIGN BODY ASPIRATION, AND INGESTION PREVENTION**

**Table 8.1: Reviews Included in Suffocation, Asphyxiation, Foreign Body Aspiration, and Ingestion Prevention Review**

| <b>REVIEW</b>  | <b>TOPIC</b>                                    | <b>INTERVENTION</b>   |
|--|---|---|
| Rivara & Thompson, 2002c (HIPRC: Choking)<br>Modified Oxman = 0.75 | Legislation, product modification and education | Education, Engineering/Environmental, and Enforcement/Legislation |

Choking hazards change over the lifespan. Adults are most likely to choke on inorganic material such as bones and teeth, older children may choke on toy parts, and toddlers are most likely to choke on organic vegetable matter (Morely, Ludemann, Moxham, Kozak, & Riding, 2004). Studies undertaken in many countries have found that nuts (especially peanuts) tend to be the most common aspirated foreign body, followed by raw carrots, dried peas and beans, popcorn kernels, and seeds (Ludemann, Hughes, & Holinger, 2000; Baharloo, Veyckemans, & Francis, 1999; Oguz, Citak, Unuvar, & Sidal, 2000; Cataneo, Reibschied, Ruiz, & Ferrari, 1997). Whole grapes and uncut hotdogs also pose a serious hazard as they can cause complete laryngeal obstruction (Morely et al., 2004).

Between 1997 and 2001, 27 children 18 months of age or younger were admitted to British Columbia’s Children’s Hospital to undergo a bronchoscopy for suspected foreign body aspiration (Morely et al., 2004). Organic materials made up the majority of organic bodies aspirated: peanuts or almonds (27 per cent), raw carrot (23 per cent), popcorn kernels (14 per cent), toys or plastic parts (7 per cent) (Morely et al., 2004).

### **8.1 Legislation and Product Modification**

The *Hazardous Products Act (HPA)* in Canada prohibits the advertising, sale and importation of hazardous products, including some products that may be a choking hazard. Items such as infant self-feeding devices, toys likely used by children under three years of age that have a component that is separable, the sizing of eyes and noses on dolls, rattles, and pacifiers are prohibited by this legislation. There is also Hazardous Product legislation in Canada that addresses small parts that may be components of carriages, strollers, cribs, cradles, expansion gates, expandable enclosures and playpens. Every component of a product that is small enough to be placed in a truncated right cylinder must be fitted or attached to the product so that it may not become detached when force is applied. There are other products that are prohibited in Canada that may pose as a strangulation hazard, namely yo-yo balls.

Health Canada Product Safety legislation regulates a small number of actual products and Canadian Standards Association, Standards Council of Canada, or Underwriters’ Laboratories of Canada may have other standards in place to prevent choking injuries (G. Stewart, personal communication, March 10, 2006).

### 8.1.1 Promising Practice

- A study evaluated several legislative interventions on choking and suffocation and found significant reductions in death rates due to entrapment in refrigerators and suffocation from plastic bags. The legislations evaluated included those concerning proper disposal of refrigerators and freezers, warning labels on plastic bags, and slat widths on cribs. The degree to which legislation was responsible for the reductions is unclear; however, it is reasonable to assume that product changes through legislation rather than parental supervision permanently remove a larger portion of the risk. (**Rivara & Thompson, 2002c**; Kraus, 1985).
- Legislation that removes the risk of choking and asphyxiation should be implemented wherever possible. Legislation that requires warning labels to be placed on products should require that the specific hazard be explained. (**Rivara & Thompson, 2002c**).

## **8.2 Education**

Education to prevent choking may include instructions to parents on how to separate children from potential choking hazards. Education may also include instruction on how to perform the Heimlich manoeuvre or CPR if a child is choking.

### 8.2.1 Limited Evidence of Effectiveness

- Study findings are limited and it is unknown whether results can be generalized. When choking information is distributed as part of a general safety campaign and opportunity is given for hands on practice, the intervention may prove more effective. (**Rivara & Thompson, 2002c**; Sunde et al., 1998; Tertinger et al., 1984).
- No recommendations can be made at this time on educational programs to reduce the risk of suffocating and choking. (**Rivara & Thompson, 2002c**).

## **8.3 Interpretation of the Evidence and Considerations**

Legislation of products that pose suffocation or choking hazards has been credited with reducing the risk of injury more so than parental knowledge and control. Products that have been suggested for banning through legislation in Europe include latex balloons, pull cords on window coverings, and drawstrings on children's clothing (MacKay, Vincenten, Brussoni, & Towner, 2006). Health authorities can lend their support to legislation to prevent choking and suffocation. As legislation can be accepted more readily by the public when associated with education, health authorities can provide support for educational activities.

Studies of educational interventions to prevent choking are limited and have not as yet proven to be effective. Health authorities can play a role in the development of the evidence base by supporting intervention strategies that show potential merit and by ensuring that rigorous evaluations are a part of all strategies.

## 9.0 FALLS PREVENTION AMONG CHILDREN

**Table 9.1: Reviews Included in Falls Prevention Review**

| REVIEW   | TOPIC   | INTERVENTION  |
|--|---|---|
| Towner et al., 2001b<br>Modified Oxman = 0.92                      | Playground safety                                 | Education,<br>Engineering/Environmental,<br>Enforcement/Legislation |
| McClure, Nixon, Spinks, & Turner,<br>2005<br>Modified Oxman = 0.83 | Community-based falls<br>prevention program       | Education   |
| Norton, Nixon, & Sibert, 2004<br>Modified Oxman = 0.63             | Playground safety                                 | Engineering/Environmental   |
| Rivara & Thompson, 2002e<br>HIPRC: Falls<br>Modified Oxman = 0.58  | Playground safety, shopping<br>carts, window bars | Engineering/Environmental   |

### 9.1 Playground Safety

Playgrounds are common source of injuries among children and a common cause of playground injury is falling from equipment. Research from The Hospital for Sick Children in Toronto found that playground injuries among children were significantly reduced after hazardous equipment was replaced with equipment compliant with safety standards set by the Canadian Standards Association (Howard et al., 2005).

#### 9.1.1 Good Practice

- An intervention increased bark depth in five playgrounds and replaced monkey bars with a rope climbing frame in one playground. These playgrounds were compared with fourteen others, where no changes were made. There were significantly fewer injuries when all playgrounds were considered, as well as when only in the playground where the monkey bars were replaced was considered. The reduction in injuries in the four playgrounds where just bark depth was increased was not significant. The other study was a community intervention trial where 24 schools were randomized to a program to encourage them to improve playground hazards. The program was effective. (**Norton, Nixon, & Sibert, 2004**; Sibert et al., 1999; Laforest et al., 2000).
- The combination of lower fall height and impact-absorbing surfaces will reduce injuries. The most important factor for the prevention of playground injuries, however, is the use of safe surface materials and the maintenance over time of the surfaces and equipment. A New Zealand study demonstrated that an intensive multifaceted community intervention was more effective in reducing playground hazards than providing hazard information alone. (**Rivara & Thompson, 2002e**; Laforest, 2001; Sibert, 2001; Macarthur, 2000; Roseveare, 1999; Mowatt, 1998; Mott, 1997; Witheaneachi, 1997; Chalmers, 1996; Sackes et al., 1992; Sosin et al., 1993; Davidson et al., 1994)(**Towner et al., 2001b**; Sibert et al., 1999).

- Compliance with playground safety standards and education results in a small improvement in the number of hazards observed in school playgrounds. (**Towner et al., 2001b**; Withaneachi & Meehan, 1998).
- Surfacing materials such as sand or wood chips to a depth of 23–31 cm (9–12 inches) can be recommended as effective injury prevention strategies. These must be regularly maintained. Optimal equipment height is 1.5 metres (5 feet). (**Rivara & Thompson, 2002e**).

## **9.2 Shopping Carts**

Shopping carts can be a cause of injuries due to children falling out of carts or becoming caught between objects while playing in a cart.

### **9.2.1 Limited Evidence of Effectiveness**

- One study (Ferrari & Baldwin) indicates that educational interventions can increase the use of seat belts on shopping carts. Unfortunately, no studies have been done to indicate that these belts are effective in decreasing injuries. The case series by Smith found that 8 of 62 injured children were properly belted, but were injured when the cart tipped over. Thus, belts alone without redesign of the carts may not be successful in eliminating these injuries. (**Rivara & Thompson, 2002e**; Ferrari & Baldwin, 1989; Smith et al., 1996).
- Educational interventions to prevent falls and injury from shopping carts cannot be recommended at present since there is no data evaluating their effectiveness. (**Rivara & Thompson, 2002e**).

## **9.3 Community-based Falls Prevention Programs**

Community-based models are characterized by sharing responsibility between experts and community members and understanding of the complexity of causal factors inherent to the injury problem.

### **9.3.1 Limited Evidence of Effectiveness**

- Community-based approaches for childhood injury prevention have become an accepted part of the overall injury control strategy; however, there is a paucity of research from which evidence regarding the effectiveness of this approach in reducing fall-related injury can be obtained. (**McClure, Nixon, Spinks, & Turner, 2005**; Guyer, 1986; Davidson, 1994; Spiegel, 1977; Fisher, 1980; Conners, 2002; Lindqvist, 2002).

## **9.4 Window Bars**

Severe and fatal injuries can occur when children fall from heights of two or more stories, usually out of windows (Rivara & Thompson, 2002e).

#### 9.4.1 Promising Practice

- Window bars to prevent falls from heights have only been evaluated in New York City. Both the educational program and the regulations appeared effective, although the regulations would be expected to have continued long term impact. Window bars appear to be effective for preventing falls. Regulations requiring bars on rental housing appears to be most appropriate. (**Rivara & Thompson, 2002e**; Spiegel & Lindaman, 1977; Barlow et al., 1983).

### **9.5 Interpretation of the Evidence and Considerations**

Studies have shown that changing surfaces to impact-absorbing materials and depths and to equipment to reduce fall heights in playgrounds can reduce the incidence of injuries. Health authorities in BC can support playground inspection and maintenance programs by ensuring that sustainable inspection programs are in place. Health authorities can utilize the expertise of public health inspectors for monitoring safety standards in the health authorities.

An intervention to prevent falls from windows using window bars in conjunction with education and regulations has been successful in one specific jurisdiction. It is possible that similar results could be attained in other jurisdictions. Health authorities can use this successful intervention as a model for interventions in the region's communities.

Community-based approaches to prevent childhood injury, including falls, are a commonly used approach to preventing injury. Unfortunately, there remains a lack of rigorous evaluations of these types of interventions, and proving their efficacy is difficult. Health authorities can support community-based injury prevention programs that incorporate rigorous evaluations.

## 10.0 COMMUNITY-BASED INJURY PREVENTION

**Table 10.1: Reviews Included in Community-based Injury Prevention Review**

| REVIEW   | TOPIC  | INTERVENTION  |
|--|--|---|
| Spinks, Turner, Nixon, & McClure, 2005<br>Modified Oxman = 1.0               | Safe communities model   | Education.<br>Engineering/Environmental, and<br>Enforcement/Legislation |
| Dinh-Zarr, Goss, Heitman, Roberts, & DiGuseppi, 2004<br>Modified Oxman = 1.0 | Prevention of alcohol-related injuries                               | Education   |
| Lyons et al., 2003<br>Modified Oxman = 1.0                                   | Environmental interventions for the prevention of injuries           | Engineering/Environmental   |
| Bruce & McGrath, 2005<br>Modified Oxman = 0.92                               | Group interventions targeting young children                         | Education   |
| Nilsen, 2004<br>Modified Oxman = 0.96  | Prevention of alcohol-related injuries                               | Education and<br>Engineering/Environmental                              |
| Towner & Dowswell, 2002<br>Modified Oxman = 0.98                             | Community-based interventions  | Education and<br>Engineering/Environmental                              |
| Towner et al., 2001b<br>Modified Oxman = 0.92                                | Primary prevention of injury among children                          | Education, Economic and<br>Enforcement/Legislation                      |
| Spinks, Turner, McClure, & Nixon, 2004<br>Modified Oxman = 0.86              | Community-based injury prevention interventions for children         | Education, Economic and<br>Engineering/Environmental                    |
| Dowswell & Towner, 2002<br>Modified Oxman = 0.92                             | Prevention of injury among socio-economically disadvantaged children | Education, Economic and<br>Engineering/Environmental                    |
| Klassen et al., 2000<br>Modified Oxman = 0.92                                | Community-based injury prevention interventions for children         | Education, Economic,<br>Legislation/Enforcement                         |

### 10.1 General Injury Prevention Interventions

#### 10.1.1 Promising Practice

- There is increasing evidence emerging regarding the effectiveness of community-based injury prevention programs. However, a positive and sustained impact on injury rates has not yet been demonstrated conclusively. (**Towner & Dowswell, 2002**; Schelp, 1987; Svanström et al., 1996; Guyer et al., 1989; Schwarz et al., 1993; Davidson et al., 1994; Kuhn et al., 1994; Ozanne-Smith et al., 1994; Hennessey et al., 1994; Ytterstad & Wasmuth, 1995; Ytterstad, 1995; Ytterstad & Sogaard, 1995; Ytterstad et al., 1998; Svanström; et al., 1995; Day et al., 1997; Petridou et al., 1997; Coggan et al., 1998; Coggan et al., 2000) (**Towner et al., 2001**; Svanström et al., 1995; Day et al., 1997; Petridou et al., 1997; Lindqvist et al., 1999; Ytterstad et al., 1998).
- Results indicate that community-based approaches are effective at increasing some safety practices, such as bicycle helmet use and car seat use among children. The evidence is less compelling that such interventions increase child pedestrian safety, increase adolescent vehicle safety by reducing drinking and driving behaviours, or reduce rates of

several categories of childhood injuries. Strong evidence supporting the effectiveness of community-based interventions is lacking, in part because few studies used randomized controlled trial design or examined injury rates as outcome measures. Nonetheless, this review identifies common elements of successful community-based approaches that should be replicated in future studies:

- The use of multiple strategies grounded in a theory of behaviour change is critical.
- To maximize success, interventions should be integrated into the community and approaches should be tailored to meet unique community needs. Challenges around language barriers should be considered while designing and implementing interventions, particularly in the multicultural society that exists in Canada.
- Community stakeholders should be included in the development of community-based strategies. This community involvement and ownership of the intervention increases the likelihood of modeling and peer pressure, leading to widespread adoption of a safety behaviour.
- When possible, a randomized controlled trial design should be used.

(**Klassen et al., 2000:** Morris, 1991; Towner, 1992; Cote, 1992; Dannenberg, 1994; DiGuseppi, 1989; Parkin, 1993; Parkin, 1995; Farley, 1996; Liller, 1995; Moore, 1990; Ekman, 1997; Tenn, 1996).

- There is a need to develop and monitor indicators to assess and monitor a culture of safety, program sustainability and long-term community involvement. Community-based injury prevention programs have been hampered by the lack of resources allocated to development and rigorous evaluation. (**Towner & Dowswell, 2002**).
- The review suggests that *group* interventions could enhance children's safety behaviours during early childhood. Elements of successful programs include group sessions that incorporate multiple interactive learning tools, including group activities and rehearsal opportunities. Regardless of the safety topic being addressed, the majority of studies demonstrated some positive effect. (**Bruce & McGrath, 2005:** Chang, 1995; Renaud, 1989; Bowman, 1987; Rothengatter, 1984; Luria, 2000; Richards, 1991; Thomson, 1992; Liller, 1998; Thomson, 1998).
- Developing partnerships between researchers, education and community agencies could provide for future collaborative opportunities and help researchers to conduct more rigorous, long-term studies. (**Bruce & McGrath, 2005**).
- Injury prevention *coalitions* have been found to consistently report significantly positive yet modest results from coalition efforts. Evaluation studies of coalitions for injury prevention report outcomes such as policy changes, statistically significant changes in health status, statistically significant changes in health risk behaviours, and statistically significant knowledge changes. Effective public health partnerships between professionals and specific populations are possible, more likely when the commitment is established over a longer time period. Community-wide initiatives did not show as

positive results as neighbourhood or specific target group coalitions. The majority of studies evaluated were supported with research or project funding as well as a hired coordinator. Community-based public health coalitions can be effective, although more research will assist in the determination of factors that contribute to coalition effectiveness. (**Kuhn, Doucet, & Edwards, 1999**).

## **10.2 World Health Organization Safe Communities Model**

The manifesto for Safe Communities states that “All human beings have an equal right to health and safety” (World Health Organization, n.d.). The Safe Communities model coordinates community-oriented efforts to enhance safety and reduce injury. Partnerships unite various community members and groups and are an essential component of the model.

A “ Safe Community” can be a municipality; a county; a city or a district of a city working with safety promotion, injury, violence , suicide and natural disaster prevention, covering all age groups, gender and areas and is a part of an international network of accredited programmes.

Safe Communities have:

1. An infrastructure based on partnership and collaborations, governed by a cross- sectional group that is responsible for safety promotion in their community.
2. Long-term, sustainable programs covering both genders and all ages, environments, and situations.
3. Programs that target high-risk groups and environments, and programs that promote safety for vulnerable groups.
4. Programs that document the frequency and causes of injuries.
5. Evaluation measures to assess their programs, processes and the effects of change.
6. Ongoing participation in national and international Safe Communities networks.

### **10.2.1 Good Practice**

- There is some evidence that the WHO Safe Communities model does reduce injuries in whole populations and further implementation of these programs is supported. (**Spinks, Turner, Nixon, & McClure, 2005**: Svanstrom et al., 1996; Bjerre & Schelp, 2000; Ytterstad, 1996; Ytterstad, 2003; Ytterstad et al., 1998; Svanstrom et al., 1995; Lindqvist et al., 2001a; Lindqvist et al., 2001b; Lindqvist et al., 1999a; Lindqvist et al., 2002; Lindqvist et al., 2001c; Lindqvist et al., 1999b; Ozanne-Smith et al., 2002; Coggan et al., 2000).
- There is sufficient evidence of the effectiveness of the Safe Communities model to warrant the establishment of an appropriately funded and conducted, global, multi-community trial. (**Spinks, Turner, Nixon, & McClure, 2005**).



### **10.3 Alcohol-related Injury Prevention Interventions**

The consumption of alcohol has been linked to injuries including motor vehicle collisions, falls, drowning, fires, burns and violence. The identification of effective interventions to reduce injuries related to alcohol consumption is important for reducing the burden of injury.

#### **10.3.1 Promising Practice**

- The results of the review show that there is a complex relationship between the outcome and the context, structure and process of community-wide injury prevention programs. The results highlight the importance of the contextual conditions of the programs and confirm that socio-economic status and social/cultural homogeneity of the intervention community are critically important factors that influence effectiveness. (**Nilsen, 2004**: Petridou et al., 1997; Davidson et al., 1994; Ozanne-Smith et al., 2002; Jeffs et al., 1993; Schwarz et al., 1993; Guyer et al., 1989; Schelp, 1987; Svanström et al., 1996; Tellnes, 1985; Robertson, 1986; Svanström et al., 1995; Lindqvist et al., 1996a; Lindqvist, 1996b; Timpka, 1999; Lindqvist, 1999; Lindqvist, 2001a; Lindqvist, 2001b; Ytterstad & Wasmuth, 1995; Ytterstad, 1995; Ytterstad, 1996; Ytterstad, 1998; Ytterstad, 2003; Bjerre & Jonell, 1999; Bjerre & Sandberg, 1998; Bjerre & Scelp, 2000; Frimodt-Möller, 1994; Day et al., 2001; Coggan et al., 2000).
- Interventions for problem drinking appear to have beneficial effects on injury risk, but this benefit does not necessarily correlate with the effect of the intervention on abstinence, alcohol consumption or drinking-related hazardous behaviour. (**Dinh-Zarr, Goss, Heitman, Roberts, & DiGuseppi, 2004**: Barber, 1995; Brown, 1980; Fitzgerald, 1985; Fleming, 1999; Fleming, 2002; Manwell, 2000; Gallant, 1968; Gentilello, 1999; Kristenson, 2002; Kuchipudi, 1990; Landrum, 1981; Longabaugh, 2001; Mann, 1994; Monti, 1999; Potamianos, 1986; Reis, 1982a; Reis, 1982b; Sitarthan, 1996; Sitarthan, 1997; Toteva, 1996; Walsh, 1991; WHO BISG, 1996; Ojehagen, 1997).
- The review indicates that interventions for problem drinking are likely to reduce the incidence of injuries but current data are insufficient to draw firm conclusions. (**Dinh-Zarr et al., 2004**).
- There is a lack of literature describing the effectiveness of programs targeting multiple injury categories due to alcohol misuse. There is a need for more sophisticated evaluations of injury prevention interventions to assess the effectiveness of these programs on injury rates. (**Nilsen, 2004**).

### **10.4 Mass Media**

#### **10.4.1 No Evidence of Effectiveness**

- Exhibitions and public information campaigns can increase knowledge but there is no recent evidence that these approaches impact injury rates. (**Towner et al., 2001**: Gielen et al., 1996; Sundelin et al., 1996; Marsh & Kendrick, 1998).

## **10.5 Interpretation of the Evidence and Considerations**

Community-based interventions are only moderately supported by the evidence as there is a lack of rigorous evaluations with measurable outcomes completed. There are, however, several components of successful community-based interventions that are believed to maximize success. These include utilizing strategies that promote behaviour change, programs that are specific and tailored to the community that is being targeted, involving the community in the development of the strategy, utilizing a randomized study design where possible, and dedicating sufficient resources to undertake a rigorous evaluation. For example PARTY (Prevent Alcohol & Risk-Related Trauma in Youth)<sup>6</sup> is an awareness program in Canada targeting teenagers. The purpose of this program is to educate youth around injury prevention and change their risky behaviours, attitudes and practices. A Canadian study evaluated the impact of the PARTY program after six weeks of its implementation and showed a significant increase in knowledge around injury prevention and a positive attitude towards safe behaviour (Nuth, Mongeon, Currie & Curra, 1999). However, further research is required to evaluate the impact of similar intervention programs. Health authorities can support community-based injury prevention interventions that show promise and can contribute to the evidence base by supporting injury prevention programs that involve a rigorous evaluation plan.

Community coalitions play an important role in the development and assessment of injury prevention initiatives. Regional health authorities can play a vital role in the creation, development and facilitation of; participation in; and support of community coalitions. Medical and public health personnel within the regional health authorities are valuable resources that can lend support and expertise to community coalitions.

There is a need to develop and monitor indicators to assess and monitor a culture of safety, program sustainability and long-term community involvement. Community-based injury prevention programs have been hampered by the lack of resources allocated to development and rigorous evaluation. (Towner & Dowswell, 2002, p. 283).

The WHO Safe Communities model has been evaluated in Sweden, Norway, Australia and New Zealand, and there have been positive results to support this initiative. Health authorities in BC can support community injury prevention coalitions that want to apply for Safe Community designation. This support can come in many forms, such as:

- Providing meeting space.
- Connecting injury prevention coalitions and businesses that have an interest in community safety.
- Assisting in the development of a business plan.
- Sharing baseline injury reports and community-level data and analysis.
- Providing an environment that will support and sustain community coalitions and the process of achieving Safe Community designation.

---

<sup>6</sup> Information on the PARTY Program is available at <http://www.partyprogram.com>.

## 11.0 SAFETY DEVICES AND HOME MODIFICATIONS

**Table 11.1: Reviews Included in Safety Devices and Home Modifications Review**

| REVIEW   | TOPIC  | INTERVENTION                                      |
|--|--|---|
| Lyons et al., 2003<br>Modified Oxman = 1.0       | Environmental interventions for the prevention of injuries           | Engineering/Environmental                         |
| Towner et al., 2001b<br>Modified Oxman = 0.92    | Primary prevention of injury among children                          | Education, Economic and Enforcement/Legislation   |
| Dowswell & Towner, 2002<br>Modified Oxman = 0.92 | Prevention of injury among socio-economically disadvantaged children | Education, Economic and Engineering/Environmental |

### 11.1 Educational Campaigns and Provision of Safety Devices

Safety devices are given away as an incentive in conjunction with home visits and education.

#### 11.1.1 Limited Evidence of Effectiveness

- Studies suggest that while educational campaigns and equipment loan schemes may have potentially positive effects in promoting behaviour change, there is limited evidence that it leads to injury reduction. Limited evidence is a result of a paucity of trials of the efficacy of and education to promote safety devices. (**Towner et al., 2001b**; Bablouzian, 1997; Camp, 1998; Thompson, 1998; Kendrick, 1999).
- Low-income families provided with safety devices designed to provide passive protection from injury tended to use them. However, there is very little evidence that the presence of safety devices, such as electric socket covers or cupboard locks, have any effect on injury risk. The provision of such devices may possibly increase awareness of home hazards but there is a risk that parents may assume children are protected and reduce supervision levels. It is important that the limitations of home safety devices is understood. (**Dowswell & Towner, 2002**; Gallager, 1985; Thompson, 1998; Spiegel, 1977).

### 11.2 Home Modifications

Many injuries, to children and the elderly, occur in the home, and interventions to reduce physical hazards, including altering building fabric, fixtures and fittings such as grab rails, stair gates, fireguards, cupboard locks, hot water tap adaptations, and lighting have been studied for their role in preventing injuries occurring in the home. A more in-depth discussion of home modification for the prevention of falls among the elderly is included in section 15 of this report.

#### 11.2.1 Limited Evidence of Effectiveness

- There is limited evidence on which to base current practice showing the effectiveness of modifying the physical environment in the home in order to prevent injuries. The lack of evidence is a result of very small samples that could not be expected to provide valid results. Multi-factorial interventions can be effective; however, it is important to consider the cost-effectiveness of specific components so scarce resources can be targeted in the

most effective manner. Further evidence is needed. (Lyons et al., 2003: Carter, unpublished; Close, 1999; Kendrick, 1999; King 2001; Stevens, 2001; van Haastregt, 2000; Vetter, 1992; Cumming 1999; Day, 2002; Hogan 2001, Tinetti, 1994; Clamp, 1998; Gielen, 2002; Hornbrook, 1994; Kelly 1987; Petridou, 1997; Poulstrop, 2000; Wagner, 1994; Ytterstad, 1996; Steinberg, 2000; Colver, 1982; Dershewitz, 1979; Paul, 1994; Schwarz, 1993; Thomas, 1984; Waller, 1993; Yates, 2001).

- More evidence is needed to show the effectiveness of modifying the home environment to remove potential hazards in order to reduce injuries. (Lyons et al., 2003).

### **11.3 Interpretation of the Evidence and Considerations**

Evidence of the effectiveness of safety devices and home modifications and associated educational campaign is limited due to the lack of good quality studies. The quality and size of trials was not sufficient to reach definitive conclusions. It is logical that physical hazards and poor design can contribute to a sequence of events that may lead to an injury. Scientific evidence is not available to support these types of interventions.

Health authorities in BC can play a role in developing the evidence base by supporting strategies and interventions that show promise and that are of good quality. Rigorous evaluations should always be a key component of all interventions.

## 12.0 MOTOR VEHICLE OCCUPANT RESTRAINT

**Table 12.1: Reviews Included in Motor Vehicle Occupant Restraint Review**

| REVIEW  | TOPIC  | INTERVENTION                                 |
|---|--|--|
| Ehiri et al., 2005<br>Modified Oxman = 1.0                            | Interventions for promoting the use of booster seats among 4- to 8-year-olds                   | Education, Enforcement/Legislation, Economic |
| Dinh-Zarr et al., 2001<br>Modified Oxman = 0.96                       | Community-based interventions to increase the use of safety belts                              | Education, Enforcement/Legislation           |
| Zaza et al., 2001<br>Modified Oxman = 0.96                            | Interventions to increase use of child safety seats  | Education, Enforcement/Legislation           |
| Dowswell & Towner, 2002<br>Modified Oxman = 0.92                      | Restraint for child car passengers   | Education, Economic                          |
| Towner et al., 2001a<br>Modified Oxman = 0.92                         | Seat belt legislation  | Enforcement/Legislation                      |
| Klassen et al., 2000<br>Modified Oxman = 0.92                         | Community-based studies to increase motor vehicle restraint use among children and adolescents | Education                                    |
| Grossman & Garcia, 1999<br>Modified Oxman = 0.92                      | Health promotion programs to increase motor vehicle occupant restraint use in young children   | Education, Enforcement/Legislation, Economic |
| Turner, McClure, Nixon, & Spinks, 2005<br>Modified Oxman = 0.83       | Community-based studies to increase motor vehicle restraint use among children and adolescents | Education                                    |
| Rivara, Thompson, Beahler, & MacKenzie, 1999<br>Modified Oxman = 0.79 | Effectiveness of primary- and secondary-enforced seat belt laws                                | Enforcement/Legislation                      |
| Grabowski & Morrissey, 2001<br>Modified Oxman = 0.33                  | Seat belt laws   | Enforcement/Legislation                      |

### 12.1 Child Motor Vehicle Restraint Promotion Programs

#### 12.1.1 Good Practice

- Several community-based interventions delivered in day care or school settings have shown increased motor vehicle restraint use among young children. Multiple strategies to promote behaviour change that also focus on increasing children's acceptance of safety seats appear to be a critical element of successful programs. (**Klassen et al., 2000:** Chang, 1985; Hazinski, 1995; Bowman, 1987; Stuy, 1993; Neuwelt, 1989).
- Studies of interventions to promote in-car safety for children show that these campaigns are partly effective in increasing restraint use. (**Dowswell & Towner, 2002:** Goodson, 1985; Roberts & Fanurik, 1986; Liberato, 1989; Stuy, 1993, Hazinski, 1995).
- Incentive and education programs reward parents for obtaining and correctly using child safety seats or directly reward children for correctly using safety seats. Sufficient scientific evidence exists to conclude that incentive and education programs are effective

in increasing child safety seat use in the short term (1 to 4 months). (**Zaza et al., 2001:** Foss, 1989; Roberts, 1986; Roberts, 1987; Stuy, 1993).

- Education-only programs provide information about the use of child safety seats and relevant skills to parents, children or professional groups. Available studies provide insufficient evidence to assess the effectiveness of education-only programs in improving knowledge about or use of child safety seats. Education remains a central component of most other effective interventions. (**Zaza et al., 2001:** Christophersen, 1985; Goebel, 1984; Tietge, 1987; Bowman, 1987; Arneson, 1990; Chang, 1985; Williams, 1997; Lavelle, 1992; Wolf, 1995).
- Based on the small number of studies and range of intervention and evaluation methodologies reviewed, it is reasonable to argue that there is some evidence that community-based programs for increasing child safety restraints to reduce motor vehicle occupant injury are effective. (**Turner, McClure, Nixon, & Spinks, 2005:** Guyer, 1989; Decina, 1994; Davidson, 1994; Ebel, 2003; Ekman, 2001; Istre, 2002; Roberts, 1988; Durkin, 1999).
- The studies included in the review had many limitations as a result of study design and methodologies utilized. These limitations could have resulted in an overestimation of the effect of car seat promotion programs. The review suggests that while some programs designed to improve the use of car seats among infants and children appear to be effective in the short term, the effects diminish over time (one or more months) following the conclusion of the intervention. (**Grossman & Garcia, 1999:** Stuy, 1993; Roberts & Fanurik, 1986; Roberts & Turner, 1986; Chang, 1985; Arneson, 1990; Foss, 1989; Pless, 1986; Liberato, 1989; Christophersen, 1982; Chang, 1989; Hletko, 1982; Nichol, 1984; Geddis, 1982; Reisinger, 1978; Reisinger, 1981; Berger, 1984; Robitaille, 1990; Colletti, 1983).

## **12.2 Child Car Seat Loan Programs**

### **12.2.1 Good Practice**

- Two studies evaluated programs that loaned infant restraint seats to low-income families. These studies suggest that such schemes can increase the number of babies restrained in cars. (**Dowswell & Towner, 2002:** Berger, 1984; Robitaille, 1990).
- The ten programs reviewed provided free loaner child safety seats, low-cost rentals, or direct giveaways. The programs also gave parents information on proper usage to increase the likelihood the safety seat would be used appropriately. Strong evidence shows the effectiveness of child safety seat distribution and education programs in improving child safety seat use. Additional supportive evidence indicates a decline in injury claims made to insurance agencies and increases in possession of child safety seats. (**Zaza et al., 2001:** Robitaille, 1990; Colletti, 1986; Culler, 1980; Geddis, 1986; Hletko, 1987; Lindqvist, 1993 ; Reisinger, 1978 ; Christophersen, 1982 ; Saalberg, 1982a ; Saalberg, 1982b).

### **12.3 Interventions to Promote the Use of Booster Seats**

Booster seats have been shown to protect children from serious crash-related injuries, including “lap belt syndrome,” where adult seatbelts can cause injuries to children in collisions rather than protecting them (Ehiri et al., 2005). Research has shown that children age 4 to 8 years have a significantly reduced risk of injury if they are restrained using a booster seat (Ehiri et al., 2005). The National Highway Traffic Safety Administration in Washington, DC recommends that children use a booster seat until they are 36 kg (80 lbs) in weight, 8 years of age, or 148 cm (58 inches) in height. Effective July 1, 2008, in BC, booster seats will be mandatory for children over 40 lbs., either to the age of 9, or when they have reached a height of 4’9”.

#### **12.3.1 Good Practice**

- Results from a meta-analysis show that interventions that combine education with incentives, such as coupons for purchase of booster seats, or distribution of free booster seats have a positive effect on acquisition and use of booster seats. (Ehiri et al., 2005; Bowman, 1987; Ebel, 2003; Johnston, 2000; O’Neil, 2005; Stevens, 2000).

### **12.4 Seat Belt Laws**

In British Columbia, the law states that all drivers must ensure that infants and children are properly secured in child restraint systems.

#### **Child Restraint Laws and Obligations to Drivers**

(MVR stands for Motor Vehicle Act Regulation, MVA stands for *Motor Vehicle Act*).

MVR 36.01 A person shall not operate a motor vehicle in which there is a child under the age of 6 unless the driver ensures that the child is securely fastened by a properly utilized and adjusted restraint system which complies with the MVA.

#### **Systems for Infants**

MVR 36.02 All infants, birth to 9 kg (20 lbs), must be restrained in a rear-facing restraint system which complies with the Canadian Motor Vehicle Safety Standard (CMVSS) 213.1.

#### **Systems for Toddlers**

MVR 36.03 Toddlers weighing 9 to 18 kg (about 20–40 lbs.) in a motor vehicle driven by a parent or guardian must be restrained in a child restraint that complies with the Canadian Motor Vehicle Safety Standard 213 which is installed in the vehicle with the adult seat belt and a top tether strap. Toddlers driven by an adult who is not the parent or guardian may be restrained as defined in 36.03 or by a lap belt.

#### **Systems for Preschoolers**

MVR 36.04 All children under the age of 6 not categorized in sections 36.02 and 36.03, shall be restrained by the lap belt. \$95.00 Fine for MVR 36.01 Infractions (plus 15 per cent surcharge for research and trauma care).

These laws have not yet been upgraded to encourage parents to use booster seats after the child has outgrown the forward-facing or convertible child restraint or child seat. Whether a

preschooler or older, a child who has just outgrown such restraints will be safer in a booster seat when first using the adult seat belt (up to approximately 8 years old and 36 kg (80 lbs) (Insurance Corporation of British Columbia, n.d.).

#### 12.4.1 Strongly Supported by the Evidence

- Studies reviewed provide strong evidence that safety belt laws are effective in increasing safety belt use and decreasing injuries and deaths. (**Dinh-Zarr et al., 2001:** Baraneik, 1988; Beaton, 1988; Bernstein, 1989; Brillhart, 1988; Campbell, 1991; Chorba, 1988; Cope, 1990; Desai, 1992; Dodson, 1988; Edcobedo, 1991; Escobedo, 1992; Fielding, 1992; Kalfus, 1987; Legge, 1990; Lestina, 1991; Loeb, 1993; Loeb, 1995; Lund, 1987; Margolis, 1996; Pace, 1986; Preusser, 1987; Preusser, 1988; Reinfurt, 1990; Russell, 1994; States, 1990; Streff, 1990; Thyer, 1993; Tipton, 1990; Ulmer, 1995; Wagenaar, 1986; Wagenaar, 1988; Wagenaar, 1990; Williams, 1987; Winnicki, 1995; Reinfurt, 1991) (**Grabowski & Morrissey, 2001:** Wagenaar, 1986; Evans, 1991).
- Two studies show evidence that legislation requiring the restraint of children in cars has a positive effect. (**Towner et al., 2001:** Margolis, 1996; Williams, 1997).
- There is strong evidence of the effectiveness of child safety seat laws to reduce fatal and non-fatal injuries and to increase child safety seat use. (**Zaza et al., 2001:** Evans, 1990; Guerin, 1985; Rock, 1996; Wagenaar, 1985; Wagenaar, 1987a; Margolis, 1988; Seekins, 1988; Sewell, 1986; Wagenaar, 1987b; Williams, 1981; Wagenaar, 1986).

## **12.5 Enforcement of Legislation**

In British Columbia, the seat belt law, enacted in 1977, is enforced by the Royal Canadian Mounted Police (RCMP) and provincial police forces.

#### 12.5.1 Good Practice

- A study evaluating a campaign that included public information, police enforcement of restraint laws, and safety education in schools and hospitals was found to be effective in increasing observed restraint use. (**Dowswell & Towner, 2002:** Hanfling, 2000).
- Techniques used in the evaluated and reviewed programs included paid advertisements, public service announcements, commentaries by community leaders on local television and radio programs, newspaper articles and editorials, displays of safety seats in public locations, and direct mailings of information about the importance and correct use of child safety seats. In studies conducted in states with existing child safety seat laws, enhanced enforcement components included institution of checkpoints, assignment of law enforcement officers dedicated to enforcing the law, and alternative penalties rather than citations, such as informational warnings or vouchers to waive fines if a safety seat is purchased. There is sufficient scientific evidence to show that community-wide information and enhanced enforcement campaigns are effective in increasing child safety seat use. (**Zaza et al., 2001:** Decina, 1994; Pless, 1986; Heathington, 1982; Lane 1984).



- The studies reviewed provide strong evidence that enhanced enforcement is effective in increasing safety belt use. (**Dinh-Zarr et al., 2001:** Dussault, 1990; Hagenzieker, 1991; Jonah, 1982; Jonah, 1985; Lund, 1989; Malenfant, 1988; Mortimer, 1990; Roberts, 1994; Rood, 1987; Solomon, 1999; Streff, 1992; Watson, 1986; Williams, 1996; Williams, 1987a; Williams, 1994; Williams, 1987b).

## **12.6 Primary Enforcement Laws**

Primary enforcement laws allow police to stop and ticket a driver or occupant because they are not restrained in a seat belt. Secondary enforcement laws only allow police to ticket a driver or occupant for not wearing a seatbelt if the vehicle is stopped for some other reason. BC currently has primary enforcement of the seatbelt law.

### **12.6.1 Strongly Supported by the Evidence**

- Studies reviewed provide strong evidence that primary safety belt laws are more effective than secondary laws in increasing safety belt use and decreasing fatalities. (**Dinh-Zarr et al., 2001:** Preusser, 1997; Ulmer, 1994; Escobedo, 1991; Escobedo, 1992; Fielding, 1992; Ulmer, 1995; Wagenaar, 1988; Winnicki, 1995; Evans, 1991; Houston, 1995; Houston, 1996; Hoxie, 1987; Lange, 1998; Solomon, 2000; Campbell, 1987; Wagenaar, 1987; Campbell, 1988).
- Primary enforcement laws appear to be more effective than secondary enforcement laws in increasing restraint use and reducing motor vehicle crash-related injuries and mortality. Experiences in other countries, namely those in Europe, Australia and New Zealand, suggest that primary laws have been effective in decreasing morbidity and mortality from motor vehicle crashes. At the time of the study, it is difficult to reliably estimate the benefit from changing secondary enforcement laws to primary enforcement laws in the United States. (**Rivara, Thompson, Beahler, & MacKenzie, 1999:** CDC, 1992; Kim, 1991; Broughton, 1990; Cope, 1990; Reinfurt, 1990; Hawaii DOT, 1989; Campbell, 1988; Petrucelli, 1987; Williams, 1987; Arora, 1985; Rood, 1985; Ashoton, 1983; Schnerring, 1983; Hakkert, 1981; Williams, 1979; Robertson, 1978; Oranen, 1977; Crinon, 1975; Desai, 1992; NHTSA, 1991; Dodson, 1988; Sidhu, 1987; Williams, 1987; Wagenaar, 1988; Partyka, 1987; Hoxie, 1987; Koushki, 1996; Zlatoper, 1991; Chorba, 1988; Connecticut DOT, 1988; Latimer, 1987; Lund, 1986; McCartt, 1987; Durbin, 1985; Christian, 1984; McKay, 1984; Hakkert, 1981; Bhattacharya, 1979; Crinion, 1975; Foldvary, 1974; Palmer, 1974; Henderson, 1973; Loeb, 1993; Thyer, 1983; Streff, 1990; Asch, 1989; Dodson, 1988; States, 1990; Pye, 1984; Lestina, 1991).

## **12.7 Interpretation of the Evidence and Considerations**

Child motor vehicle restraint promotion programs show mixed evidence of efficacy. Evaluations of programs that include incentives in conjunction with education have scientific evidence of increasing child safety seat use over the short term. Child car seat loan programs are effective at increasing use, both for infant seats and booster seats for older children. Health authorities in BC can provide support to community campaigns that include incentives and loan of child safety seats and booster seats.

Effective July 1, 2008, in BC, booster seats will be mandatory for children over 40 lbs., either to the age of 9, or when they have reached a height of 4'9". The new booster seat law will apply to rental cars and passenger vans as well. Health authorities can partner with local law enforcement to raise awareness and encourage enforcement of the new law.

## **13.0 POISONING PREVENTION AMONG YOUTH AND ADULTS**

**Table 13.1: Reviews Included in Poisoning Injury Prevention Review**

| <b>REVIEW</b>                                  | <b>TOPIC</b>                                   | <b>INTERVENTION</b>     |
|--|--|-------------------------|
| Keifer, 2000<br>Modified Oxman = 0.77          | Interventions for reducing pesticide poisoning | Engineering/Environment |
| Morgan & Majeed, 2004<br>Modified Oxman = 0.71 | Restricting paracetamol through packaging      | Engineering/Environment |

Unintentional poisonings result from exposure to noxious substances, such as carbon monoxide, cleaning fluids, petroleum products, and legal and illegal substances.

Factors contributing to unintentional poisonings in adults are:

- Not reading and following product label instructions.
- Storage of medicines near chemicals.
- Cluttered medicine cabinets.
- Transfer of chemicals from original packaging to food or beverage containers.
- Alcohol or substance abuse (D. Kent, personal communication, 2005).

Common household products such as cleansers, cosmetics, mouthwash, detergents and plants are involved in unintentional poisonings, as well as common pharmaceutical products such as cough and cold medicines, vitamins and prescription drugs (Rajabali et al., 2006).

BC averaged 275 deaths per year due to illicit drug overdose, with methamphetamine-related death rising at a significant rate (Stephany, 2004). High hospital separation rates were observed for both males and females, age 25 and over, from 1990 to 2004, from unintentional poisonings due to drugs (Rajabali et al., 2006). The problematic use of prescription medications is often associated with morphine or codeine-based products, anti-anxiety medications, sleep aids and anti-depressants (Rajabali et al., 2006).

In addition to drugs, alcohol was another common cause of unintentional poisoning; this method commonly occurred in those aged 25 to 74 years in BC (Rajabali et al., 2006). Rates for unintentional poisoning in BC from 1990 to 2004 due to alcohol are not as high as that of drugs; however, it is a leading cause of unintentional poisonings (Rajabali et al., 2006).

There is a lack of poison prevention initiatives targeting youth and adults when compared to those targeting children. Raising awareness of poison prevention resources among youth and adults will lower morbidity and mortality rates due to unintentional poisoning. Education campaigns need to be developed and tailored for youth and adult consumers and disseminated in forums appropriate for the youth and adult populations.

### **13.1 Regulations to Restrict Sales of Paracetamol (Acetaminophen)**

Paracetamol (acetaminophen) poisoning has been linked to availability; a study in the United Kingdom reported availability as the main reason for taking paracetamol (Morgan & Majeed, 2004). Regulations introduced in 1998 in the United Kingdom restricted sales of paracetamol in order to reduce paracetamol poisoning.

#### **13.1.1 Promising Practice**

- Three studies of liver units all suggest that admissions and transplants decreased after the introduction of the 1998 packaging restrictions. (**Morgan & Majeed, 2004**; Hughes et al., 2003; Hawton et al., 2001; Prince et al., 2000).
- Hospitalization due to paracetamol poisoning appeared to decrease in 5 out of 6 studies, with decreases ranging from 11 to 31 percent, while the evidence for decreased mortality is conflicting and severity of poisoning does not seem to be affected. (**Morgan & Majeed, 2004**; Turvill et al., 2000; Hawton et al., 2001; Bateman et al., 2003; Hughes et al., 2003; Robinson et al., 2000; Thomas & Jowett, 2001; Sheen et al., 2002).
- Despite the introduction of nationwide legislation (1998) to restrict sales in the United Kingdom, paracetamol is still implicated in a large number of drug poisoning deaths. This suggests that restricting access to paracetamol is insufficient in itself. (**Morgan & Majeed, 2004**).

### **13.2 Pesticide Exposure**

Techniques to increase pesticide safety are designed to isolate the chemical from a worker. This could be through training in personal protective equipment, decreasing spillage, or removing workers before exposure reaches dangerous levels (Keifer, 2000).

#### **13.2.1 Limited Evidence of Effectiveness**

- Several studies were found that have tested various techniques for reducing exposure on small numbers of subjects under very carefully controlled conditions. The ultimate intervention would be to terminate the use of many toxic pesticides commonly used or to substitute toxic pesticides with harmless products. (**Keifer, 2000**; Gomes et al., 1999; Lander et al., 1992; Lander & Hinke 1992; Nigg et al., 1986; Nigg et al., 1993; Davies et al., 1982; Archibald et al., 1995; Fenske, 1988; Fenske et al., 1987; Fenske et al., 1987; Fenske et al., 1990; Methner & Fenske, 1994; Methner & Fenske, 1994; Methner & Fenske 1996; Rutz & Krieger 1992; Putnam et al., 1983; McConnell et al., 1992; Filmore & Lessenger 1993).

## **PRIMARY RESEARCH**

### **13.3 Safe and Proper Storage**

- A container study, collecting poison information in BC over a 12-month period in 2001, collected cases of unintentional ingestion of a chemical product from a household or commercial food or beverage containers (Lepik, Hayes, Kent, & Hancock, 2003). Adults were the most frequent victims of this cause of poisonings, which can result in serious morbidity or death. The most common chemicals ingested were bleach, detergents, petroleum distillates and corrosive cleaners (D. Kent, personal communication, 2005). Active techniques include proper storage of chemicals and medicines, keeping products in the original containers and other behavioural modifications. Identification of behaviours that promote safety is crucial in the prevention of unintentional poisonings (D. Kent, personal communication, 2005).

### **13.4 Prevention Program Development**

- Prevention is most effective when it focuses on reducing risk and/or strengthening protection in young lives. Programs that focus on developing life skills, that have intensive participation and that are interactive are more effective in reducing substance use and have produced stronger and longer lasting positive effects on substance use (Schinke, Brounstein, & Gardner, 2002).
- Focus treatment on stabilization and harm reduction to increase life expectancy and quality of life (van den Brink & van Ree, 2003).

### **13.5 Interpretation of the Evidence and Considerations**

There is some evidence that restricting access and availability to acetaminophen can reduce poisoning. Health authorities can support proposed strategies or legislation that may restrict availability. With respect to poisoning from pesticides, health authorities can support initiatives in the region that aim to reduce exposure to toxic pesticides and the encourage use of harmless products.

Health authorities can support all educational initiatives that aim to raise awareness of the issue of safe and proper storage of chemicals. Through public health nurses and physicians, the importance of safe and proper storage of household chemicals can be translated to the public. Health authorities can also support drug and alcohol abuse prevention programs that require intensive participation and interaction and focus on the development of life skills.

## 14.0 FALLS PREVENTION AMONG YOUTH AND ADULTS

Table 14.1: Reviews Included in Falls Injury Prevention Review

| REVIEW   | TOPIC  | INTERVENTION  |
|--|--|---|
| Rivara & Thompson, 2000<br>Modified Oxman = 0.92 | Prevention of falls in the construction industry | Education, Engineering/Environment, and Enforcement/Legislation |

Falls are a leading cause of injury among youth and adults. According to BC EDISS (Emergency Department Injury Surveillance Systems) from 2001 to 2003, falls among children and youth are most likely to occur during leisure activities and informal sports, and are most likely to occur at home, in a sports and athletics area, or at a school, institution or public area (Bawa, Brussoni, De Gagne, Han, & Smith, 2004b).

Among adults age 25 to 64 years, falls were most likely to occur while engaging in paid work, informal sports and leisure activities, and falls were most likely to occur in the home, in a sports and athletics area, street or highway area, a trade or service area, or in an industrial and construction area (Bawa, Brussoni, De Gagne, Han, & Smith, 2004a).

### 14.1 Occupational Injuries: Construction

#### 14.1.1 Good Practice

- Good evidence exists that regulations, such as the standard addressing excavation practices, have reduced injuries and deaths. Inspections also appear to have made an impact in other industries. The effectiveness of training programs in reducing the rate of injuries to workers has been reviewed. (**Rivara & Thompson, 2000**: U.S. Congress, Office of Technology Assessment, 1995; Gray & Scholz, 1993; Cohen & Colligan, 1998).
- While the evidence was suggestive that training made a difference, the lack of rigorous research designs, appropriate control groups and measurement of injury as an outcome limit the conclusions that can be drawn. (**Rivara & Thompson, 2000**: U.S. Congress, Office of Technology Assessment, 1995; Gray & Scholz, 1993; Cohen & Colligan, 1998).

#### 14.1.2 Limited Evidence of Effectiveness

- The inclination angle appears to be the most important intervention to reduce falls from ladders; no programs have been evaluated to improve appropriate use of ladders. (**Rivara & Thompson, 2000**: Nelson et al., 1997).
- Research on falls from scaffolding has focused mostly on devices to arrest falls such as body harnesses. However, no prospective cohort or case-control studies have been conducted to assess the impact of these devices on falls injuries, or on the impact of programs to increase the use of such equipment. (**Rivara & Thompson, 2000**: Saarela, 1989).

## **PRIMARY RESEARCH**

### **14.2 Fall Technique**

- Healthy young males can learn to reduce impact forces during forward falls after a ten-minute instruction. Without such instruction, no such improvement was attained. Retention of the skill at three weeks was poor; however, over a three-month period there is evidence that subjects taught themselves how to reduce the force of falling on their wrists after as few as five falls spaced three weeks apart (Lo, McCabe, DeGoede, Okuizumi, & Ashton-Miller, 2003).

### **14.3 Slip Prevention on Icy Surfaces**

- In this study, the Coefficient of Friction (COF) of four types of shoes on five different walking surfaces was investigated. The influence of intrinsic and extrinsic risk factors was studied as well. Sand and gravel on icy roads had a positive effect on improving the COF. Slip and falls is a multi-faceted area and factors such as perception of risk, aging, training, experience and postural balance need to be considered (Abeysekera & Gao, 2001).

### **14.4 Falls in Public Places**

- Strategies to prevent slip and falls in shopping centres (grocery stores and shopping malls) should be implemented and enforced at the managerial level. Regular inspection of the physical condition of floors and other walking surfaces and corrective housekeeping action based on inspections appear to be the most effective strategies (Hantula, DeNicolis Bragger, & Rajala, 2001).

### **14.5 Interpretation of the Evidence and Considerations**

Evidence exists that standards, inspections and training programs in the construction field can reduce injuries and deaths. Health authorities can support initiatives that would introduce more rigorous safety standards in the workplace. Health authorities can push for effective maintenance of community public spaces, sidewalks and roads.

## **15.0 FALLS PREVENTION AMONG SENIORS**

The evidence that is summarized in this section is from the 2004 report by the Provincial Health Officer (PHO), entitled *Prevention of Falls and Injuries Among the Elderly*. Three systematic reviews were used in the PHO report: RAND, 2003; Canadian Best Practices Guide (Scott, Dukeshire, Gallagher, & Scanlan, 2001); and Gillespie et al., 2001. Another systematic review was published in 2004 (McClure et al., 2004) and was not included in the PHO report. The systematic reviews have found the following evidence-based results.

### **15.1 Exercise/Physical Therapy Interventions**

#### **15.1.1 Good Practice**

- Exercise programs can be an effective prevention strategy, but more research is needed to determine if one type of exercise is more effective than others and which exercises are best for seniors with chronic health conditions or disabilities (**PHO, 2004**).
- Research studies have supported both general physical activity, such as walking, cycling, mild aerobic movements or other endurance activities, and specific exercise regimes that are geared towards balance, strength and flexibility (**RAND, 2003**).
- The review confirmed that evidence from three randomized controlled trials showed programs of muscle strengthening and balance retraining, individually prescribed by a trained health professional, were likely to be beneficial. Results of a group Tai Chi program showed that the program was also likely to be effective, but noted that there was insufficient evidence to assess the effectiveness of other group exercise interventions (**Gillespie et al., 2001**).
- The Canadian Best Practices Guide concludes that while evidence supports exercise regimes—particularly balance training, weightlifting and Tai Chi exercises—more research is needed to determine the types of exercise programs that are most effective in managing the different types of balance and/or mobility problems (**Scott, Dukeshire, Gallagher, & Scanlan, 2001**).

### **15.2 Environmental Modifications**

#### **15.2.1 Good Practice**

- Environmental modifications can be effective, particularly if the senior has manual or financial help to modify their environment (**PHO, 2004**).
- According to the Canadian Best Practices Guide, an important aspect of successful home modification is to ensure that identified hazards are actually changed. Programs that not only had individuals going into senior's homes to conduct environmental assessments but that also made the necessary repairs or modifications were more successful than programs that simply identified the hazards and left it to the seniors to make the necessary modifications (**Scott et al., 2001**).



- The review reports that home hazard assessment and modifications is likely to be beneficial, if professionally prescribed (by a trained occupational therapist) to older people with a history of falling. There is less evidence of benefit of home hazard modification for elderly people without a history of falling (**Gillespie et al., 2001**).
- The RAND systematic review concludes that environmental modification is probably an effective adjunct to clinical assessment and exercise intervention (**RAND, 2003**).
- Neither the RAND review nor the Gillespie review were able to find enough evidence to either support or discount the effectiveness of environmental modification outside the home. More research and work needs to be done to design and implement effective prevention programs to remove hazards that increase the risk of falls in streets and public spaces (**PHO, 2004**).

## **15.3 Clinical Interventions**

### **15.3.1 Good Practice**

- The use of thorough, focused clinical assessments can help identify and then reduce the risk of falls, if followed up by targeted intervention, such as exercise or environmental modification (multi-factorial interventions) (**PHO, 2004**).
- The RAND review concluded that research evidence supports a focused falls risk assessment with follow-up as the most effective component of a falls prevention program, along with standardized data collection for recording fall incidents (**RAND, 2003**).
- The Canadian Best Practices Guide found that clinical assessments proved useful in a variety of settings, and administered by a variety of professionals or trained volunteers. Clinical assessments could be implemented by emergency room nurses and doctors, in health centres by either doctors or nurses and in the senior's home either by trained health professionals or by trained volunteers (**Scott et al., 2001**).

## **15.4 Population-based Interventions**

A population-based falls prevention program includes several falls prevention measures introduced together as a package across an entire community or a significant portion of a community. A population-based intervention is a term that is used interchangeably with community-based interventions and can be defined as “the coordinated program of activity in which the strategies and countermeasures are implemented in whole communities” (McClure et al., 2004, p. 4). The McClure review includes institutional residences, such as nursing homes and assisted care facilities in the definition of community. Examples of interventions assessed in the McClure review include interventions that target knowledge, attitudes, behaviours, medication use, footwear, home hazard reduction, home visits, promotion of physical and mental activity, mass media, community walking programs and improvements to lighting and conditions of roads and walkways. The interventions use health personnel to deliver the intervention, including nurses, general practitioners and trained home helpers.

#### 15.4.1 Good Practice

- Although the studies reviewed contained methodological limitations, consistent reductions in fall-related injuries were reported. Despite these limitations, the authors support a preliminary claim that population-based approaches to the prevention of fall-related injuries is effective and that these interventions can form the basis of public health practice. (**McClure et al., 2004**; Kempton, 2000; Lindqvist, 2001; Poulstrop, 2000; Svanstrom, 1996; Ytterstad, 1996).

### **15.5 Medication Modification**

#### 15.5.1 Good Practice

- The Canadian Best Practices Guide, as well as Gillespie et al. (2001) and the RAND review (2003), all used the one randomized placebo controlled trial that existed at the time to test the theory of psychotropic drug withdrawal as a way to reduce falls. All three reviews concluded that prevention programs featuring withdrawal from psychotropic medication were likely to be beneficial. (**PHO, 2004**).

### **15.6 Hip Protectors**

#### 15.6.1 Good Practice

- A systematic review completed in the spring of 2002 indicated that different designs and models of hip protectors used in the studies were likely to be equally effective. However, new devices are coming on the market and until those have had their effectiveness proven by a randomized control trial, it cannot be assumed that all hip protectors will be equal. More evidence is needed as to whether soft-shell products provide the same benefits as hard-shell products. Doctors and staff at long-term care institutions should only recommend those products that have been proven. Compliance and cost of the products are issues that reduce use and effectiveness of hip protectors. (**Parker, Gillespie, & Gillespie, 2002**).

### **15.7 Multi-factorial Interventions**

#### 15.7.1 Good Practice

- The RAND review concluded that multi-factorial interventions begin with a thorough clinical assessment of the individual senior's risk factors for falling and then interventions are implemented based on these assessments, to deal with the medical management of problems, medication risk, behaviour, home modifications, and education. (**RAND, 2002**).
- The Canadian Best Practices Guide reviewed seven multi-factorial studies and found evidence for their effectiveness. (**Scott et al., 2001**).

- The Gillespie review also concluded from the available research evidence that prevention strategies were likely to be beneficial if they included multi-disciplinary, multi-factorial screening and assessment of health (such as review of medications, nutritional status and medical history) and environmental risk factors (such as inappropriate bed and chair height, flooring and surfaces) followed by appropriate interventions. Some of the important identified fall risk factors, recommended for inclusion as part of multi-factorial screening and assessment, include: musculoskeletal weakness, balance and gait deficit, visual deficit, mobility limitation, cognitive impairment, impaired functional status and postural hypotension (Rubenstein, Robbins, Josephon, Schulman, & Osterweil, 1990; Oliver & Masud, 2004) Screening plus intervention was likely to work equally well for the general population of community-dwelling seniors, for older people with a history of falling or for people selected because of known risk factors. (Gillespie et al., 2001).

## **15.8 Education**

### **15.8.1 Limited Evidence of Effectiveness**

- There is insufficient evidence to conclude whether education alone is an effective intervention, but it does play a role as part of a multi-factorial strategy that includes clinical assessment followed by targeted intervention. The benefits of staff education have not been well tested in long-term care. (PHO, 2004).
- Evaluations of education strategies alone are inconclusive. The Cochrane and RAND reviews both conclude that there is insufficient evidence to either support or refute education programs alone in terms of changing behaviours or reducing falling risk among seniors. (PHO, 2004).
- The Canadian Best Practices Guide concludes that education strategies may play an important role for seniors as part of a multi-faceted prevention program, by helping them become aware and concerned about the risks of falls, which may then increase their readiness to adopt one or more strategies to reduce falls. (Scott et al., 2001).

## **15.9 Interpretation of the Evidence and Considerations**

These recommendations are taken from the 2004 PHO report entitled *Prevention of Falls and Injuries Among the Elderly*.

Regional health authorities are in a position to establish a community-based as well as a population-based surveillance system that would serve to collect, analyze and report data. This data would help us better understand the risk and impact of falls by region, across all sectors of the health care delivery system and in the community. The population level data would provide a complete profile of the trends and patterns of injuries. Considering the establishment of the National Ambulatory Care Reporting System (NACRS) in the emergency departments of hospitals would enable the health authorities to collect and analyze the incidence, prevalence and cause of various injuries in their regions, including the pre-event circumstances that lead to an injury from a fall.

Health authorities are in a position to work and collaborate with other organizations, community (municipalities) and government partners in their regions to develop, implement and expand effective injury prevention programs. The health authorities also have access to untapped data about falls in acute care, long-term care and from people receiving home support services. These data should be collected, collated and used, to develop, implement and evaluate prevention programs. In addition, the data can also provide the necessary knowledge and evidence to the health workers so they are able to enhance their roles in creating safer environments for our aging population.

**Recommendation:** Regional health authorities should consider adding specific falls assessments to any clinic currently in place—such as geriatric assessment clinics or influenza vaccination clinics. Assessments should include basic mobility tests, vision checks, medication reviews and questions about prior falls and contributing factors. Handouts could follow on prevention strategies and contact information on local resources such as the seniors’ exercise programs, reliable home modification contacts, equipment “Loan Cupboards”, etc. Red Cross “Loan Cupboards” are available in each regional health authority for seniors or those with disabilities requiring equipment (such as canes, walkers, grab bars, hip protectors) to try out or to use on a short-term basis prior to obtaining their own supplies. It is recommended that regional health authorities continue to support and expand these facilities in collaboration with the Red Cross.

**Recommendation:** In order to build regional capacity for implementing falls prevention programs and activities, regional health authorities should work with community partners such as municipalities (particularly municipal engineers), recreation centres, seniors’ organizations and existing falls prevention programs that are sponsored by other organizations. Activities to promote include safety and access improvements in public places, home modifications, and exercise programs tailored to the needs and abilities of the elderly, particularly those focusing on balance, strength and flexibility. Health authorities should partner with Veterans Affairs Canada/ Health Canada projects in their areas to utilize and build on the knowledge and experience gained by these community-based initiatives.

**Recommendation:** Regional health authorities should provide learning opportunities for their health employees on the best practices for designing, implementing and evaluating falls prevention programs. This can be done through in-services, training sessions, conferences, or through recommended changes to existing curricula of local colleges and universities. In addition, regional health authorities should consider sponsoring workshops, such as those carried out in Capital Health, Edmonton focusing on seniors in all settings—the well and frail elderly living at home, those in supportive housing or rehabilitation facilities, and those in long-term care and acute care settings—to identify local actions that can be taken to prevent falls and injuries in the elderly.

## **16.0 FUTURE DIRECTIONS**

Health authorities in BC have a unique role to play in the prevention of unintentional injuries. This can include direct education and awareness through public health officials and primary care professionals as well as modelling through safe work practices and environments. Health authorities can also support and advocate for the development and enforcement of policy development and laws that are shown to reduce the burden of injury. Most importantly, health authorities can act as a catalyst for the development of community action and coalitions to bring thought and solutions to injury prevention in their region.

Health authorities are in a position to establish a community-based as well as a population-based surveillance system that would serve to collect, analyze and report injury data. The population-level data would provide a complete profile of the trends and patterns of injuries and help us better understand the risk and impact of injuries by region, across all sectors of the health care delivery system and in the community.

Health authorities have facilities where community members can convene. Health authorities can also share resources such as audio-visual equipment, libraries, information and data. Health authorities have a wealth of expertise available in their medical and public health officials.

Health authorities are also motivated to improve the health and well-being of the population they serve and they can take the opportunity to do that through the prevention of injuries. For dramatic injury prevention to occur in British Columbia, societal change is needed in the way we think about injury. In a role as facilitator and catalyst, health authorities can influence thinking and culture toward societal change.

## REFERENCES

- Abeyssekera, J. & Gao, C. (2001). The identification of factors in the systematic evaluation of slip prevention on icy surfaces. *International Journal of Industrial Ergonomics*, 28, 303–313.
- Attewell, R.G., Glase, K., & McFadden, M. (2001). Bicycle helmet efficacy: a meta-analysis. *Accident Analysis and Prevention*, 33, 345–352.
- Barns, E.B., & Bero, L.A. (1998). Why review articles on the health effects of passive smoking reach different conclusions. *Journal of the American Medical Association* 279(19), 1566–1570.
- Baharloo, F., Veyckemans, F., & Francis, C. (1999). Tracheobronchial foreign bodies: presentation and management in children and adults. *Chest*, 115,1357–1362.
- Bawa, H., Brussoni, M., De Gagne, D., Han, G., & Smith, D. (2004a). *Emergency Department Injury Surveillance System (EDISS): Adults data report 2001-2003*. Vancouver, BC: BC Injury Research and Prevention Unit.
- Bawa, H., Brussoni, M., De Gagne, D., Han, G., & Smith, D. (2004b). *Emergency Department Injury Surveillance System (EDISS): Child & youth data report 2001-2003*. Vancouver, BC: BC Injury Research and Prevention Unit.
- Brenner, R.A., Saluja, G., & Smith, G.S. (2003). Swimming lessons, swimming ability, and the risk of drowning. *Injury Control and Safety Promotion*, 10(4), 211–216.
- Bruce, B. & McGrath, P. (2005). Group interventions for the prevention of injuries in young children: a systematic review. *Injury Prevention*, 11, 143–147.
- Bunn, F., Collier, T., Frost, C., Ker, K., Roberts, I., & Wentz, R. (2003a). Area-wide traffic calming for preventing traffic related injuries. *The Cochrane Database for Systematic Reviews*, 2.
- Bunn, F., Collier, T., Frost, C., Ker, K., Roberts, I., & Wentz, R. (2003b). Traffic calming for the prevention of road traffic injuries: systematic review and meta-analysis. *Injury Prevention*, 9, 200–204.
- Cataneo, A.J., Reibschied, S.M , Ruiz, R.L., & Ferrari, G.F. (1997). Foreign body in the tracheobronchial tree. *Clinical Pediatrics*, 36, 701–706.
- Chapman, H.R. & Curran, A.L.M. (2004). Bicycle helmets—does the dental professional have a role in promoting their use? *British Dental Journal*, 196(9), 555–560.
- Chen, G., Meckle, W., & Wilson, J. (2002). Speed and safety effect of photo radar enforcement on a highway corridor in British Columbia. *Accident Analysis & Prevention* 34, 129–138.
- Coffman, S. (2003). Bicycling injuries and safety helmets in children: Review of research. *Orthopaedic Nursing*, 22(1), 9–15.

**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

---

- Cohen, A. & Colligan, M.J. (1998). *Assessing occupational health and safety training: A literature review*. Cincinnati, OH: National Institute for Occupational Safety and Health.
- Committee on Poison Prevention and Control, Board on Health Promotion and Disease Prevention. (2004). *Forging a poison prevention and control system*. Washington, DC: National Academies Press.
- Cortes, L.M. & Hargarten, S.W. (2001). Preventive Care in the Emergency Department: A Systematic Literature Review on Emergency Department-based Interventions that Address Smoke Detectors in the Home. *Academic Emergency Medicine* 8(9), 925–929.
- Desapriya, E., Han, G., Turcotte, K., & Pike, I. (2007). *Motor vehicle related injuries in British Columbia*. Vancouver, BC: BC Injury Research and Prevention Unit.
- DiGuseppi, C. & Higgins, J.P.T. (2000). Systematic review of controlled trials of interventions to promote smoke alarms. *Archives of Disease in Childhood*, 82, 341–348.
- DiGuseppi, C. & Higgins, J.P.T. (2001). Interventions for promoting smoke alarm ownership and function. *The Cochrane Database for Systematic Reviews*, 3.
- Dinh-Zarr, T., Goss, C., Heitman, E., Roberts, I., & DiGuseppi, C. (2004). Interventions for preventing injuries in problem drinkers. *The Cochrane Database for Systematic Reviews*, 3.
- Dinh-Zarr, T.B., Sleet, D.A., Shults, R.A., Zaza, S., Elder, R.W., Nichols, J.L., et al. (2001). Reviews of evidence regarding interventions to increase the use of safety belts. *American Journal of Preventive Medicine*, 21(Suppl.4), 48–65.
- Dowswell, T. & Towner, E. (2002). Social deprivation and the prevention of unintentional injury in childhood: a systematic review. *Health Education Research: Theory & Practice*, 17(2), 221–237.
- Driscoll, T.R., Harrison, J.A., & Steenkamp, M. (2004). Review of the role of alcohol in drowning associated with recreational aquatic activity. *Injury Prevention*, 10, 107–113.
- Duperrex, O., Roberts, I., & Bunn, F. (2002). Safety education of pedestrian for injury prevention. *The Cochrane Database for Systematic Reviews*, 3.
- Ehiri, J.E., Ejere, H.O.D., Magnussen, L., Emusus, D., King, W., & Osberg, J.S. (2005). Interventions for promoting booster seat use in four to eight year olds traveling in motor vehicles. *The Cochrane Database of Systematic Reviews*, 1.
- Foss, R.D. & Beirness, D.J. (2000). *Bicycle helmet use in British Columbia: Effects of the helmet use law*. Ottawa, ON: Traffic Injury Research Foundation.
- Gillespie, L.D., Gillespie, W.J., Robertson, M.C., Lamb, S.E., Cumming, R.G., & Rowe, B.H. (2001). Interventions for preventing falls in elderly people. *The Cochrane Library*, 3.

**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

---

- Grabowski, D.C. & Morrissey, M.A. (2001). The effect of state regulations on motor vehicle fatalities for younger and older drivers: A review and analysis. *The Milbank Quarterly*, 79(4).
- Gray, W.B. & Scholz, J.T. (1993). Does regulatory enforcement work? A panel analysis of OSHA enforcement. *Law & Society Review* 27, 177–213.
- Grossman, D.C. & Garcia, C.C. (1999). Effectiveness of health promotion programs to increase motor vehicle occupant restraint use among young children. *American Journal of Preventive Medicine*, 16(Suppl. 1), 12–22.
- Health Canada. (2001). *Guide to Canadian consumer chemical product assessment*. Retrieved March 8, 2006, from [http://www.hc-sc.gc.ca/cps-spc/pubs/indust/hpa-pcc/guide-evaluation\\_e.html](http://www.hc-sc.gc.ca/cps-spc/pubs/indust/hpa-pcc/guide-evaluation_e.html).
- Hantula, D.A., DeNicolis Bragger, J.L., & Rajala, A.K. (2001). Slips and falls in stores and malls: Implications for community-based prevention. *Journal of Prevention & Intervention in the Community*, 22(1), 67–80.
- Howard, A.W., MacArthur, C., Willan, A., Rothman, L., Moses-McKeag, A., & MacPherson, A.K. (2005). The effect of safer play equipment on playground injury rates among school children. *Canadian Medical Association Journal* 172(11), 1443–1446.
- Insurance Corporation of British Columbia. (n.d.). *Child seats – Child restraint laws*. Retrieved February 29, 2008, from [http://www.icbc.com/road\\_safety/carseat\\_law.asp](http://www.icbc.com/road_safety/carseat_law.asp).
- Joseph, K.E., Adams, C.D., Goldfarb, I.W., & Slater, H. (2002). Parental correlates of unintentional burn injuries in infancy and early childhood. *Burns*, 28, 455–463.
- Karkhaneh, M., Kalenga, J-C., Hagel, B.E., & Rowe, B.H. (2006). Effectiveness of bicycle helmet legislation to increase helmet use: a systematic review. *Injury Prevention*, 12, 76–82.
- Keifer, M.C., (2000). Effectiveness of interventions in reducing pesticide overexposure and poisonings. *American Journal of Preventive Medicine*, 18(Suppl. 4), 80–89.
- Klassen, T.P., MacKay, J.M., Moher, D., Walker, A., & Jones, A. J. (2000). Community-based injury prevention interventions. *The Future of Children: Unintentional Injuries in Childhood*, 10(1), 83–110.
- Kuhn, M., Doucet, C., & Edwards, N. (1999). *Effectiveness of coalitions in heart health promotion, tobacco use reduction, and injury prevention: A systematic review of the literature 1990-1998*. Ontario: Effective Public Health Practice Project.
- Kwan, I. & Mapstone, J. (2002). Interventions for increasing pedestrian and cyclist visibility for the prevention of death and injuries. *The Cochrane Database for Systematic Reviews*, 3.
- Lepik, K., Hayes, L., Kent, D., & Hancock, L. (2003). *Poisoning from chemicals stored in food containers*. Proceedings from BC Injury Prevention Conference, April 2003.



**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

---

- Liao, C. & Rossignol, A. (2000). Landmarks in burn prevention. *Burns*, 26, 422–424.
- Lo, J., McCabe, G.N., DeGoede, K.M., Okuizumi, H., & Ashton-Miller, J.A. (2003). On reducing hand impact force in forward falls: Results on a brief intervention in young males. *Clinical Biomechanics*, 18, 730–736.
- Ludemann, J.P., Hughes, C.A., & Holinger, L.D. (2000). Management of foreign bodies in the airway. In: T.W. Shields, J. LoCicero, & R.B. Ponn (Eds.), *General thoracic surgery Vol. 1 (5th ed.)* (pp. 853–862). Philadelphia: Lippincott Williams and Wilkins.
- Lyons, R.A., Sander, L.V., Weightman, A.L., Patterson, J., Jones, S.A., Lannon, S., et al. (2003). Modification of the home environment for the reduction of injuries. *The Cochrane Database for Systematic Reviews*, 4.
- MacKay, M., Scanlan, A., Olsen, L., Reid, D., Clark, M., McKim, K., et al. (2001). *Sports and recreation injury prevention strategies: Systematic review and best practices*. Vancouver, BC: BC Injury Research and Prevention Unit.
- Mackay, M., Vincenten, J., Brussoni, M., & Towner, L. (2006). *Child Safety Good Practice Guide: Good investments in unintentional child injury prevention and safety promotion*. Amsterdam: European Child Safety Alliance, Eurosafe.
- Massa, N. & Ludemann, J.P. (2004). Pediatric caustic ingestion and parental cocaine abuse. *International Journal of Pediatric Otorhinolaryngology*, 68, 1513–1517.
- McClure, R., Nixon, J., Spinks, A., & Turner, C. (2005). Community-based programmes to prevent falls in children: a systematic review. *Journal of Paediatrics and Child Health*, 41, 465–470.
- McClure, R., Turner, C., Peel, N., Spinks, A., Eakin, E., & Hughes, K. (2004). Population-based interventions for the prevention of fall-related injuries in older people. *The Cochrane Database of Systematic Reviews*, 2.
- Morely, R.E., Ludemann, J.P., Moxham, J.P., Kozak, F.K., & Riding, K.H. (2004). Foreign body aspirations in infants and toddlers: Recent trends in British Columbia. *The Journal of Otolaryngology*, 33(1), 37–41.
- Morgan, O. & Majeed, A. (2004). Restricting paracetamol in the United Kingdom to reduce poisoning: A systematic review. *Journal of Public Health*, 27(1), 12–18.
- Nilsen, P. (2004). What makes community-based injury prevention work? In search of evidence of effectiveness. *Injury Prevention*, 10, 268–274.
- Nixon, J., Spinks, A., Turner, C., & McClure, R. (2004). Community based programs to prevent poisoning in children 0-15 years. *Injury Prevention*, 10, 43–46.
- Norton, C., Nixon, J., & Sibert, J.R. (2004). Playground injuries to children. *Archives of Disease in Childhood*, 89, 103–108.

**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

---

- Nuth, J., Mongeon, S., Currie, S., & Curra, C. (1999). An evaluation of P.A.R.T.Y.—A Canadian injury prevention program for teenagers. *Academic Emergency Medicine*, 6(5), 494.
- Transport Canada, (n.d.). Office of Boating Safety. Retrieved March 8, 2006, from <http://www.tc.gc.ca/BoatingSafety/menu.htm>.
- Oguz, F., Citak, A., Unuvar, E., & Sidal, M. (2000). Airway foreign bodies in childhood. *International Journal of Pediatric Otorhinolaryngology*, 52, 11–16.
- Oliver, D., & Masud, T. (2004). Preventing falls and injuries in care homes. *Age and Ageing*, 33, 532–535.
- Oxman, A. (1994). Systematic reviews: Checklist for review articles. *BMJ*, 309, 648–651.
- Parker, M.J., Gillespie, L.D., & Gillespie, W.J. (2002). Hip protectors for preventing hip fractures in the elderly. *The Cochrane Library*, 3.
- Pilkington, P., & Kinra, K. (2005). Effectiveness of speed cameras in preventing road traffic collisions and related casualties: A systematic review. *BMJ*, 330, 331–334.
- Provincial Health Officer. (2004). *Prevention of falls and injuries among the elderly*. Victoria, BC: Ministry of Health Planning.
- Rajabali, F., Han, G., Artes, S., Smith, D., Brussoni, M., & Joshi, P. (2005). *Unintentional injuries in British Columbia: Trends and patterns among children & youth*. Vancouver, BC: BC Injury Research and Prevention Unit.
- Rajabali, F., Smith, D., Han, G., Turcotte, K., & Kinney, J. (2006). *Unintentional Injuries in British Columbia: Trends and patterns among adults & seniors*. Vancouver, BC: BC Injury Research and Prevention Unit.
- RAND Report. (2003). *Draft evidence report and evidence-based recommendations: Falls prevention interventions in the medicare population*. Baltimore, MD: US Department of Health and Human Services, Centres for Medicare and Medicaid Services.
- Rivara, F.P., Thompson, D.C., Beahler, C., & MacKenzie, E.J. (1999). Systematic reviews of strategies to prevent motor vehicle injuries. *American Journal of Preventive Medicine*, 16(1 Suppl), 1–5.
- Rivara, F.P. & Thompson, D.C. (2000). Prevention of falls in the construction industry: Evidence for program effectiveness. *American Journal of Preventive Medicine*, 18(Suppl. 4), 23–26.
- Rivara, F.P. & Thompson, D.C. (2002a). *Best practices: Bicycles*. Seattle, WA: Harborview Injury Prevention & Research Center. Retrieved February 25, 2008, from <http://depts.washington.edu/hiprc/practices/topic/bicycles/index.html>.

**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

---

- Rivara, F.P. & Thompson, D.C. (2002b). *Best practices: Child pedestrians*. Seattle, WA: Harborview Injury Prevention & Research Center. Retrieved February 25, 2008, from <http://depts.washington.edu/hiprc/practices/topic/pedestrians/index.html>.
- Rivara, F.P. & Thompson, D.C. (2002c). *Best practices: Choking, aspiration and suffocation*. Seattle, WA: Harborview Injury Prevention & Research Center. Retrieved February 25, 2008, from <http://depts.washington.edu/hiprc/practices/topic/suffocation/index.html>.
- Rivara, F.P. & Thompson, D.C. (2002d). *Best practices: Drowning*. Seattle, WA: Harborview Injury Prevention & Research Center. Retrieved February 25, 2008, from <http://depts.washington.edu/hiprc/practices/topic/drowning/index.html>.
- Rivara, F.P. & Thompson, D.C. (2002e). *Best practices: Falls*. Seattle, WA: Harborview Injury Prevention & Research Center. Retrieved February 25, 2008, from <http://depts.washington.edu/hiprc/practices/topic/falls/index.html>.
- Rivara, F.P. & Thompson, D.C., (2002f). *Best practices: Fires and burns*. Washington: Harborview Injury Prevention & Research Center. Retrieved February 25, 2008, from <http://depts.washington.edu/hiprc/practices/topic/fireburns/index.html>.
- Rivara, F.P. & Thompson, D.C. (2002g). *Best practices: Poisoning*. Seattle, WA: Harborview Injury Prevention & Research Center. Retrieved February 25, 2008, from <http://depts.washington.edu/hiprc/practices/topic/poisoning/index.html>.
- Royal, S.T., Kendrick, D., & Coleman, T. (2005). Non-legislative interventions for the promotion of cycle helmet wearing by children. *The Cochrane Database for Systematic Reviews*, 3.
- Rubenstein, L.Z, Robbins, A.S, Josephon, K.R., Schulman, B.L., & Osterweil, D. (1990). The value of assessing falls in an elderly population: a randomized Clinical Trial. *Annals of Internal Medicine*, 113(4), 308–316.
- Scott, V., Dukeshire, S., Gallagher, E., & Scanlan, A. (2001). *A best practices guide for the prevention of falls among seniors living in the community*. Prepared for the Federal/Provincial/Territorial Ministers of Health and Ministers Responsible for Seniors. Ottawa, ON: Minister of Public Works and Government Services Canada.
- Schinke, S., Brounstein, P., & Gardner, S. (2002). *Science-based prevention programs and principles* [Dhhs Pub. No. (SMA) 03-3764]. Rockville, MD: Centre for Substance Abuse Prevention, Substance Abuse and Mental Health Services Administration.
- SMARTRISK. (2001). *The economic burden of unintentional injury in British Columbia*. Toronto: BC Injury Research and Prevention Unit.
- Spinks, A., Turner, C., McClure, R., Acton, C., & Nixon, J. (2005). Community-based programmes to promote use of bicycle helmets in children aged 0-14 years: A systematic review. *International Journal of Injury Control and Safety Promotion*, 12(3), 131–142.

**Core Public Health Functions for BC: Evidence Review**  
**Unintentional Injury Prevention**

---

- Spinks, A., Turner, C., McClure, R., & Nixon, J. (2004). Community-based prevention programs targeting all injuries for children. *Injury Prevention, 10*, 180–185.
- Spinks, A., Turner, C., Nixon, J., & McClure, R. (2005). The ‘WHO Safe Communities’ model for the prevention of injuries in whole populations. *The Cochrane Database for Systematic Reviews, 3*.
- Stephany, K. (2004). *Psychoactive substance use and related problems in BC*. Vancouver, BC: Kaiser Foundation.
- Thompson, D.C. & Rivara, F. P. (2004). Pool fencing for preventing drowning in children. *The Cochrane Database for Systematic Reviews, 4*.
- Thompson, D.C., Rivara, F.P., & Thompson, R. (1999). Helmets for preventing head and facial injuries in bicyclists. *The Cochrane Database for Systematic Reviews, 3*.
- Towner, E. & Dowswell, T. (2002). Community-based childhood injury prevention interventions: what works? *Health Promotion International, 17*(3), 273–284.
- Towner, E., Dowswell, T., & Jarvis, S. (2001a). Updating the evidence. A systematic review of what works in preventing childhood unintentional injuries: Part 1. *Injury Prevention, 7*, 161–164.
- Towner, E., Dowswell, T., & Jarvis, S. (2001b). Updating the evidence. A systematic review of what works in preventing childhood unintentional injuries: Part 2. *Injury Prevention, 7*, 249-253.
- Towner, E., Dowswell, T., Mackereth, C., & Jarvis, S. (2001c). *What works in preventing unintentional injuries in children and young adolescents? An updated systematic review*. Prepared for the Health Development Agency (HAD). London. Department of Child Health, University of Newcastle upon Tyne; 2001. Retrieved February 25, 2008, from [http://www.nice.org.uk/niceMedia/documents/prevent\\_injuries.pdf](http://www.nice.org.uk/niceMedia/documents/prevent_injuries.pdf).
- Turcotte, K., Kinney, J., Joshi, P., & Pike, I. (2005, November). *Motor vehicle crashes among young drivers: Systematic review & recommendations for BC*. Vancouver, BC: BC Injury Research and Prevention Unit.
- Turner, C., McClure, R., Nixon, J., & Spinks, A. (2004). Community-based programmes to prevent pedestrian injuries in children 0-14 years: A systematic review. *Injury Control and Safety Promotion, 11*(4), 231–237.
- Turner, C., McClure, R., Nixon, J., & Spinks, A. (2005). Community-based programs to promote car seat restraints in children 0-16 years – A systematic review. *Accident Analysis and Prevention, 37*, 77–83.
- Turner, C., Spinks, A., McClure, R., & Nixon, J. (2004). Community-based interventions for the prevention of burns and scalds in children. *The Cochrane Database for Systematic Reviews, 3*.

***Core Public Health Functions for BC: Evidence Review***  
**Unintentional Injury Prevention**

---

United States Congress, Office of Technology Assessment. (1995). *Gauging control technology and regulatory impacts in occupational safety and health— An appraisal of OSHA’s analytical approach* [OTA-ENV-635]. Washington DC: US Government Printing Office.

van den Brink, W., & van Ree, J.M. (2003). Pharmacological treatments for heroin and cocaine addiction. *European Neuropsychopharmacology*, 13(6), 476–487.

World Health Organization Collaborating Centre on Community Safety Promotion. (n.d.). Safe Communities. Retrieved March 9, 2006, from [http://www.phs.ki.se/csp/who\\_safe\\_communities\\_en.htm](http://www.phs.ki.se/csp/who_safe_communities_en.htm).

Zaza, S., Sleet, D.A., Thompson, R.S., Sosin, D.M., Bolen, J.C., & the Task Force on Community Preventive Services. (2001). Reviews of evidence regarding interventions to increase use of child safety seats. *American Journal of Preventive Medicine*, 21(Suppl. 4), 31–47.

## **APPENDIX 1: BACKGROUND ON HARBORVIEW INJURY PREVENTION & RESEARCH CENTER SYSTEMATIC REVIEWS**

The best practices systematic reviews from the Harborview Injury Prevention & Research Center (HIPRC) are relied upon for many of the topics covered in this review or reviews. Background on the design of the reviews is included below but more information on HIPRC Best Practices Systematic Reviews can be found at: <http://depts.washington.edu/hiprc/practices/index.html>

The HIPRC, at the Harborview Medical Center, University of Washington is one of ten injury-control centers in the United States, supported by the Centers for Disease Control and Prevention (CDC). The Best Practices Project, a series of systematic reviews, aims to provide information on what works and what does not work for the prevention of injuries to children and adolescents. The reviews are based on studies that have some type of comparison group including randomized control trials, a controlled trial, a case control study, a cohort study, a comparison across communities, time series analysis or a before and after study. Case series and laboratory study types are not included.

All studies included in the reviews include at least one of these outcomes:

- Risk of death.
- Risk of hospitalization.
- Risk of injury requiring Emergency Department care.
- Risk of injury requiring physician care in other setting.
- Change in injury severity.
- Change in intermediate outcomes (e.g., reduction in crash or fall event).
- Change in measured or observed behaviour (e.g., wearing bicycle helmets).
- Change in costs.

Studies with the following outcomes are excluded from the reviews:

- Changes in knowledge.
- Changes in attitudes.
- Changes in beliefs.
- Changes in self-reported behaviour.

## **APPENDIX 2: SEARCH STRATEGIES**

1. The scalds and burns search strategy was based on the terms:

1. Burn\* or burns, chemical or burns, electric or burns, inhalation or eye burns
2. Scald\*
3. Accident prevention or “wounds and injuries” or safety or safety management
4. Prevent\* or strateg\* or intervention\* or program\* or campaign\*
5. 1 OR 2
6. 3 OR 4
7. 5 AND 6
8. limit 7 to English language
9. limit 8 to yr= “2000 – 2005”
10. limit 9 to “review articles”

2. The poisoning search strategy was based on the terms:

1. exp poisoning\*
2. accident prevention or “wounds and injuries” or safety or safety management
3. child
4. prevent\* or strateg\* or intervention\* or program\* or campaign\*
5. 1 AND 2
6. 5 AND 3
7. 6 AND 4
8. limit 7 to English language
9. limit 8 to = “2000 – 2005”
10. limit 9 to “review articles”

3. The falls search strategy was based on the terms:
  1. accidental falls
  2. accident prevention or “wounds and injuries” or safety or safety management
  3. child
  4. prevent\* or strateg\* or intervention\* or program\* or campaign\*
  5. 1 AND 2 AND 3
  6. limit 5 to English language
  7. limit 6 to “review articles”
  8. limit 7 to yr= “2000 – 2005”
4. The drowning search strategy was based on the terms:
  1. drowning AND near drowning
  2. accident prevention or safety
  3. “wounds and injury”
  4. prevent\* OR strateg\* intervention\* OR program\* OR campaign\*
  5. 2 OR 3 OR 4
  6. 1 AND 5
  7. limit 6 to English language
  8. limit 7 to yr= “2000 – 2005”
  9. limit 8 to “review articles”
5. The bicycle and pedestrian search strategy was based on the terms:
  1. pedestrian\*
  2. bicycle\*
  3. 1 AND 2



4. prevent\* OR strateg\* OR intervention\* OR program\* OR campaign\*
  5. “wounds and injury”
  6. accident prevention or safety
  7. 3 AND 4
  8. 7 AND 5
  9. 8 AND 6
  10. limit 9 to English language
  11. limit 10 to yr= “2000 – 2005
  12. limit 11 to “review articles”
- 6.** The foreign body aspiration search strategy was based on the terms:
1. airway obstruction
  2. foreign body
  3. choke
  4. choking
  5. aspiration
  6. prevent\* OR strateg\* OR intervention\* OR program\* OR campaign\*
  7. accident prevention OR “wounds and injury”
  8. 1 OR 2 OR 3 OR 4 OR 5
  9. 6 OR 7
  10. 8 AND 9
  11. limit 10 to English language
  12. limit 11 to yr= “2000 – 2005
  13. limit 12 to “review articles”



## **APPENDIX 4: MODIFIED OXMAN QUALITY ASSESSMENT TOOL**

---

|  |           |
|--|-----------|
| 1. Was the purpose of the review clearly stated  | 2 / 1 / 0 |
| 2. Did the authors clearly describe their strategy for identifying primary research studies on the review topic?       | 2 / 1 / 0 |
| 3. Was the search strategy appropriate?  | 2 / 1 / 0 |
| 4. Did the authors clearly report their criteria for deciding which studies to include and exclude?                    | 2 / 1 / 0 |
| 5. Were the inclusion/exclusion criteria appropriate?  | 2 / 1 / 0 |
| 6. Did the authors clearly report their criteria for assessing the quality/validity of studies included?               | 2 / 1 / 0 |
| 7. Was the validity assessment appropriate?  | 2 / 1 / 0 |
| 8. Did the authors clearly report their strategy for combining study results (either qualitatively or quantitatively)? | 2 / 1 / 0 |
| 9. Were study results combined appropriately?  | 2 / 1 / 0 |
| 10. Were the findings clearly summarized (either graphically or in words)?   | 2 / 1 / 0 |
| 11. Did the authors adequately discuss data limitations and study inconsistencies?                                     | 2 / 1 / 0 |
| 12. Were the stated conclusions supported by the data presented?   | 2 / 1 / 0 |

---

---

Yes = 2

Partial = 1

No = 0

NA = 0

## **APPENDIX 5: DATA EXTRACTION TABLES**

To obtain a copy of this appendix, please contact:

Healthy Children, Women & Seniors & Injury Prevention Branch  
Population Health and Wellness  
Ministry of Health  
4<sup>th</sup> Floor, 1515 Blanshard St.  
Victoria, BC V8W 3C8  
Phone: (250) 952-2311